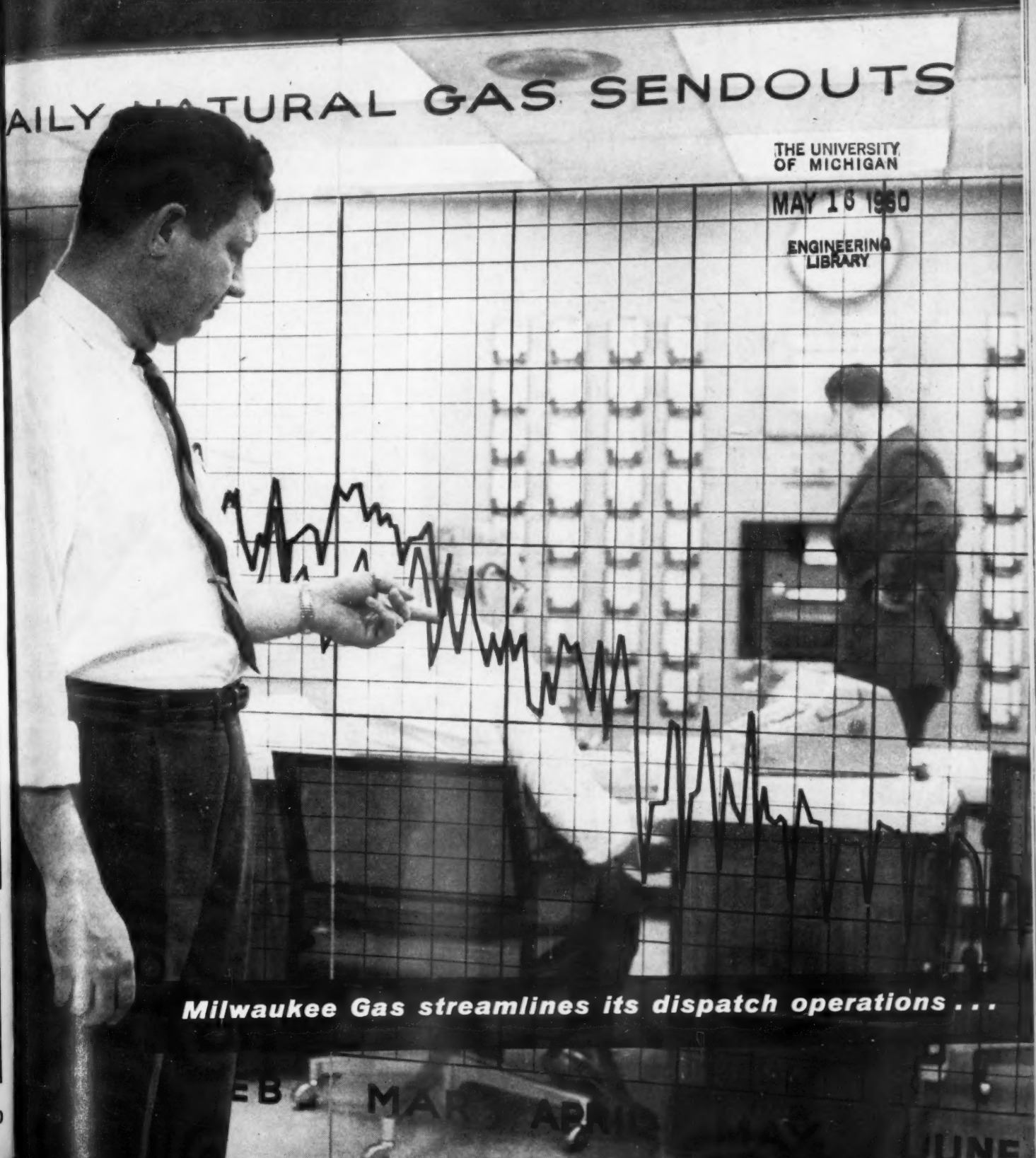
American
MAY 1960

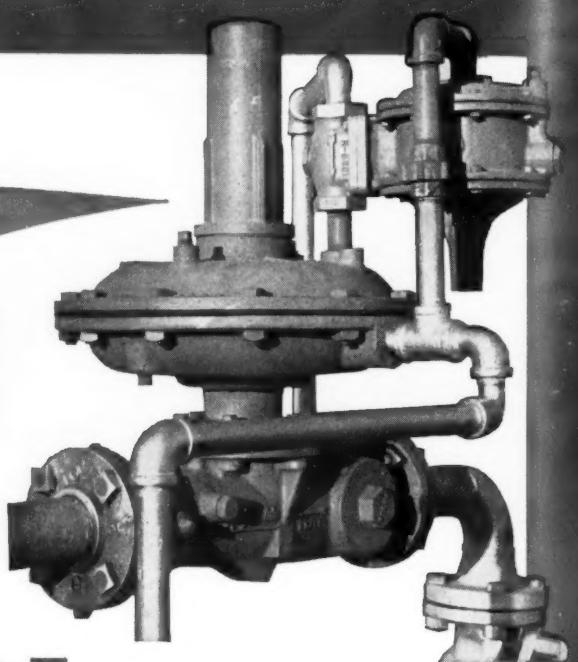
Gas Journal

THE MAGAZINE OF GAS DISTRIBUTION



Milwaukee Gas streamlines its dispatch operations . . .

REYNOLDS



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PILOT.. ..LIGHTS

Graphic Proof . . .

. . . of the need for a streamlined, fully instrumented gas dispatch system is pointed out on this month's cover by Bob Danforth, Milwaukee Gas Light Company's general superintendent of gas supply. Day-to-day ups and downs in gas load demand, combined with high winter peaks and the usual summer valleys, work to give dispatchers grey hairs and ulcers. At Milwaukee Gas Light, though, the gas dispatch operation personnel are living a bit easier, thanks to a combination of computers, telemeters, alarm systems, and a host of modern electronic equipment developments.

Don't Give LNG The Cold Shoulder

At −258 degrees Fahrenheit, natural gas (or methane, we should say) becomes a liquid . . . a real cool liquid with a lot of hot possibilities. As you'll note by reading the two-part discussion on pages 23 through 30 in this issue, LNG is being investigated for use in peak shaving; is being used in Great Britain to help provide base load gas; is available now in the U.S.; can be transported easily by special tanker; can be stored readily in special tanks built of cryogenic materials, and . . . most important . . . has become an important item in the thinking of gas distribution men . . . more than just a novelty.

American Gas Journal

ONLY MAGAZINE EDITED EXCLUSIVELY FOR THE GAS DISTRIBUTION INDUSTRY

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The LubOseal stop was first introduced to the gas industry in 1952. The many safety and operating advantages of this new stop created a great deal of initial interest. The Operating Management of many gas companies, whose systems were either under high pressures or changing to higher pressures, immediately requested samples for testing purposes.

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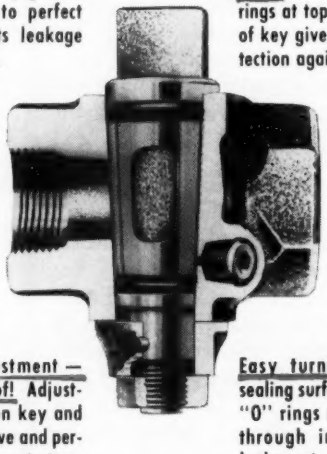

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M C F

NEWS HILITES OF THE INDUSTRY

Need for legislation that would exempt natural gas producers from utility-type regulation was reaffirmed by the Federal Power Commission in its annual report to Congress on its operations in the fiscal year 1959 (which ended last June 30). The commission's stand, one it has had consistently, calls for amendments to the Natural Gas Act of 1938 that would assure consumers of adequate supplies of gas over long terms at reasonable prices. Recommended specifically by the FPC was that its authority to fix producer rates on an "area basis" be spelled out. Gas prices, it noted, should be on a commodity basis and "favored nation" escalation clauses should be banned.

Japan's natural gas supply has been nearly doubled by discovery of a single new well that is capable of producing 35,000,000 cu ft per day. The new well, in the Kubiki gas field, is operated by Teikoku Oil Company, Japan's leading producer of oil and gas. Production is currently limited to about 2,500,000 cu ft per day due to limited local market. A 100-mile gas line to the city of Toyama will provide additional markets for the gas by the end of 1960. Price of the gas is equivalent to 64 cents per Mcf. Until discovery of the new well, daily production in Japan of natural gas averaged 48,000,000 cu ft.

More gas was pulled out of the interstate market in East Texas recently when the FPC ordered a price cut on gas offered for sale by Phillips Petroleum and Union Producing Company. The two companies rejected an FPC certificate authorizing them to sell 20,000,000 cu ft per day to United Gas Pipeline Company in Rusk County. FPC set the price at 15 cents per Mcf. Phillips asked for 17 cents. Phillips then decided to sell the gas intrastate to Lone Star Gas Company, at an undisclosed price.

Gas-eating germs may help find future oil and gas deposits. Certain varieties of the gas-eating germs, reports Dr. Raymond Strawinski, are found in substantial numbers where oil and gas deposits are also present. It is theorized that gases from the deposits rise through the earth and the germs feed on the gas seepage. It could be a boon for oil and gas prospectors, Dr. Strawinski reports, and he claims great accuracy with his microbial surveys. He cites drilling of four exploratory wells in southeast Louisiana at depths of over 16,000 ft. Two wells that turned out to be producers were within the area outlined by the bacterial study, he noted. The two non-producers were outside the bacterial map area.

Gas production in the Lacq area of southwest France is expected to quadruple in the next two years as result of an intensive development program. First stage in the development of the Lacq field has been completed to provide annual production of nearly 71-billion cu ft to supply south and central areas of France through a new 1560-mile network of pipelines now nearing completion. Some 38 percent of the gas will be sold in the southwestern region of France around the field itself, 26 percent will go to the Paris area, 26 percent to central France, and the remaining 10 percent will be sold along the west coast of France. Discovered eight years ago, the Lacq field was hailed as an opportunity to develop the southwestern French region and bring about decentralization of French industry from the Paris region but the efforts to spread French industrial wealth have met with little response. Lacq gas, however, may eventually bring in foreign money — both Swiss and Spanish interests are considering importing natural gas into their countries from the field.

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WITH INSTANT LATERA

DIGGING WHEEL POWER-SHIFTS 5 FEET FROM SIDE TO SIDE

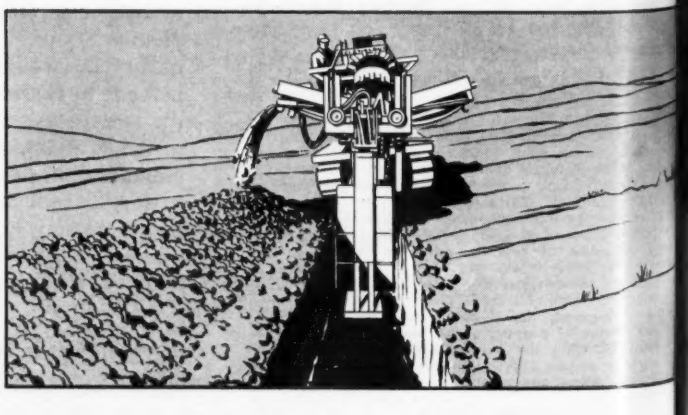
Digs trench behind either crawler or anywhere within its 6-foot width

Lateral shifting of the JS-30's wheel, up to 2½ feet to either side of center, is done hydraulically under lever control at operator's location, so trench can be dug at any point within 6-foot-wide path made by the crawler. Edge of 24-inch trench can be dug 5 inches outside either track, permitting trench to be flush with parallel pavement, curbs, sidewalks, etc. With wheel tilted, trench can be dug virtually flush with trees, poles, fences and other above-ground obstructions.

INSTANT DIGGING WHEEL TILT

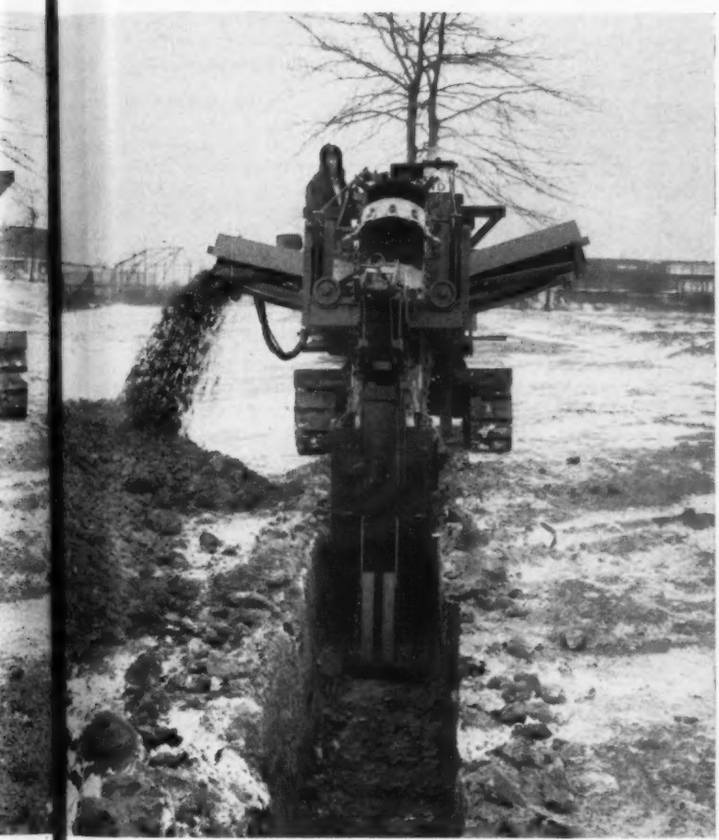
cuts blocking, cribbing costs

Hydraulic power-tilting of the JS-30's digging wheel to either side of vertical – a total tilting range of 14°– under lever control at the operator location, permits digging vertical trench on side slopes and in similar conditions with one crawler track on a higher level than the other. This eliminates the necessity of blocking, cribbing, etc. in such conditions. Power-tilt adds 7 inches to the outside cut of the digging wheel. This in combination with lateral power-shift permits digging trench virtually flush with above-ground obstructions.



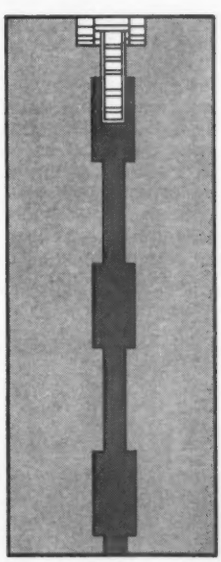
a trencher of amazing utility

DIGGING WHEEL POSITIONING



EXCAVATES BELLHOLES saves on trench width

Power-shifting and power-tilting of the JS-30's digging wheel are especially valuable in cutting trench to extra width required at pipe joints. This permits digging trench to narrow width except where bellholes are required. By utilizing power-shift the JS-30 can dig up to 6 ft. wide, down to 5½ ft. deep — reduces slower hoe-work to clean-up, etc.



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DIGGING CAPACITY: 5 ranges, from 11" to 24" wide, to 5½' deep; to 6' wide with power-shift.

POWER: 370 cu. in. diesel—59 HP @ 1250 RPM.

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HEIGHT: 8' 2" digging; 9' 5" roading.

LENGTH: 27' 3".

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NEWSREEL

New Crop of Ideas Reaps Rewards

Charles L. Mee, left, chairman of Northern Illinois Gas Co.'s employee suggestion system, congratulates four top idea men for the year's best ideas. They are, left to right, Jake O. Ruder, first prize winner of $150; Frank A. Kasperkevicz, second, $100; O. Keith Kennedy, $75 in third place tie; and George M. Long, also $75 in the third place tie. Ruder, foreman, devised shut-off equipment that enables removing lateral connections from mains without interrupting service to customers. He received $250 as an initial award. Kasperkevicz, maintenance foreman, improved the design of a stopper for high pressure gas mains; his initial award was $1000. Kennedy, system protection advisor, suggested a centralized control and machine preparation of letters cautioning contractors to avoid damaging gas mains and service lines. Resulting expediency and economy won him $250 in awards. Long, senior engineer for NI-Gas, also received $250 in initial and additional awards with his proposal to change distribution pressure charts at 2-week intervals instead of every 7 days.

New Engineering-Unit Prefixes Adopted

Numbers in the space age are soaring to astronomical proportions diminishing to the infinitesmal. To meet the needs of engineers and mathematicians in this new age, the National Bureau of Standards has adopted a new, expanded set of engineering-unit prefixes to express nearly every kind of multiple or sub-multiple that might be encountered.

The new prefix set was adopted in early 1960. It was proposed originally at the 1958 Paris meeting of the International Committee on Weights and Measures. Included in the set are eight prefixes that have long been used, such as kilo for 1000, mega for one-million, deci for one-tenth, etc. Newest additions are giga, for one-billion; tera, for one-trillion; nano for 10^{-9}, and pico for 10^{-12}.

Under the new system, one teraton would equal one trillion tons, just as one megaton now equals one million tons.

Symbol	Prefix	Multiples and Sub-Multiples
T	tera	$1\,000\,000\,000\,000 = 10^{12}$
G	giga	$1\,000\,000\,000 = 10^{9}$
M	mega	$1\,000\,000 = 10^{6}$
k	kilo	$1\,000 = 10^{3}$
h	hecto	$100 = 10^{2}$
dk	deka	$10 = 10$
d	deci	$0.1 = 10^{-1}$
c	centi	$0.01 = 10^{-2}$
m	milli	$0.001 = 10^{-3}$
u	micro	$0.000\,001 = 10^{-6}$
n	nano	$0.000\,000\,001 = 10^{-9}$
p	pico	$0.000\,000\,000\,001 = 10^{-12}$

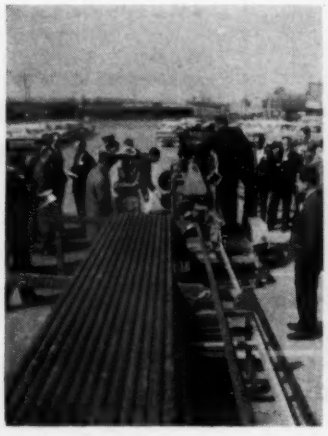
Formation of a new company, Conch Methane Company Limited, by interests of Continental Oil Company, the Union Stock Yard and Transit Company of Chicago, and the Canadian Shell Ltd., a company of the Royal Dutch Shell Group promises accelerated development of commercial transportation of methane in liquid form. Continental Oil and Union Stock Yards, both American companies with offices in Houston and Chicago respectively, have pioneered research in the liquefied natural gas field through their joint subsidiary, **Constock International Methane Limited.** Constock, after much costly research in transporting natural gas in liquefied form at temperature of minus 258 degrees F, have acquired valuable "know-how" and patents in this new field. As a result of this work Constock and the Gas Council in the United Kingdom participated through a joint company, **British Methane Ltd.,** in a project to ship liquid methane from Lake Charles, Louisiana, to the United Kingdom. The first cargo was successfully delivered February 1959 by the **Methane Pioneer,** a tanker jointly owned by Constock and the Gas Council. Since then this ship has continued to deliver regularly 2000-ton cargoes of liquid methane to the North Thames Gas Board's special depot at Canvey Island, Essex.

Continental Oil Company plans to dig a 200,000 bbl capacity underground cavern to store propane, near Ponca City, Oklahoma. The project is estimated to cost $1,275,000, "only a fraction" of the cost of comparable above-ground steel storage tanks, C. D. Hull, manager of Conoco's Ponca City refinery said. Fenix & Scisson, Inc., leading cavern consulting and contracting firm, has excavation underway, however, the cavern is not scheduled for completion until early 1961. Cavern will be dug in limestone about 350 ft from the surface with a series of connecting tunnels, about 20 ft in height, extending out from a central shaft.

Frank H. Trembly, director of sales, Philadelphia Gas Works, has been cited for his outstanding leadership, initiative and dedicated effort" to the gas industry by the Pennsylvania Gas Association. An achievement plaque was presented to Trembly by A. J. Wilmer, chairman of the PGA sales promotion committee, at the association's annual mid-winter sales conference. As first chairman of the National Television Committee of the Gas Industry, Trembly and his committee were instrumental in motivating the A.G.A. to sponsor the nationwide debut of "Playhouse 90."

Yard coating of small size pipe with pressure-sensitive plastic tape with a new specially-designed wrapping machine was demonstrated at the National Association of Corrosion Engineers annual meeting in Dallas by the Polyken Division of the Kendall Company. Equipment was used on 2-in. steel pipe. At left, pipe is fed into the tape wrapping machine; center, Don McCabe of Polyken describes features of machine's operation; at right, joint of fully-wrapped pipe is taken off stand and rolled down ramp.

(For more details, circle No. 2 on the reader reply card)



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Power train and track assembly are designed to big tractor specifications for long, trouble-free life. The T-340 puts 66 inches of track on the ground for exceptionally fine balance on slopes or rough terrain.

Fast Reverser gives five speeds coming *and* going for bulldozer or loader applications. Or for heavy drawbar work, specify Torque Amplifier drive. In tough going, cut speed ⅓ while boosting pull-power up to 45 per cent, *on-the-go*, without shifting. When the going gets easier, resume full gear speed at a touch of the TA lever, again, *on-the-go*.

*Maximum engine hp, corrected to standard conditions

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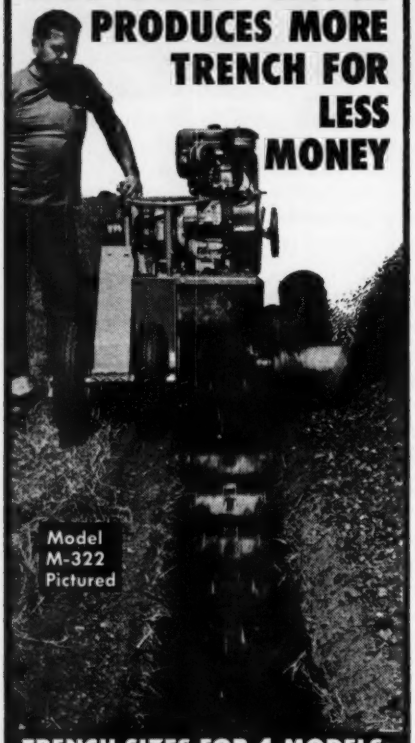
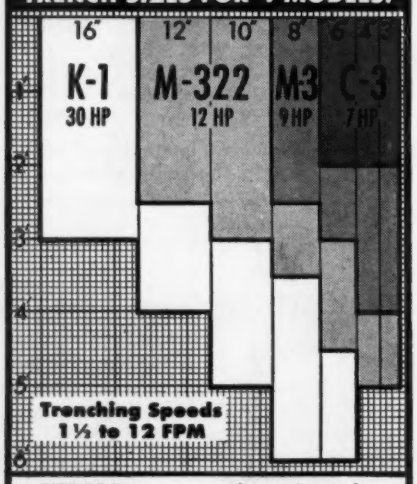


TRENCH SIZES FOR 4 MODELS:



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Newsreel

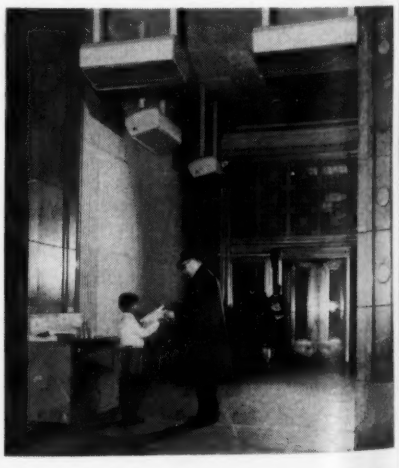
Compact Cars added to Washington Gas Light's fleet for testing include a Corvair, a Valiant, and a Falcon. Looking over the new additions are Charles A. Collins, manager of transportation and buildings (right), and Leon A. Kerns, superintendent of transportation. Company is also testing several other makes including Volkswagen, Lark, Hillman, and Rambler American.

Johns-Manville Corp. has entered the plastic pipe manufacturing field with the acquisition of Franklin Plastics, Inc. of Franklin, Pennsylvania. Under the agreement, which included a cash purchase of Franklin Plastics, J-M acquires company principal assets, including a manufacturing plant located on a 1½-acre site at Franklin, Pennsylvania, 80 miles north of Pittsburgh. Plant provides 26,000 sq ft of operating space and has an annual rated production capacity valued in excess of $4,000,000. Dixon P. Downey, owner and president of Franklin Plastics, will continue operation of Gulf Stream Plastics, Inc., at Hialeah, Florida, for the manufacture of fittings for plastic pipe and custom moulded industrial components. "This purchase will provide J-M with a new product line of flexible extruded thermoplastic pipe," A. R. Fisher, chairman of J-M, said. Responsibility for producing and selling the J-M extruded plastic pipe will be assigned to the J-M Pipe Division, which also manufactures and markets a broad line of asbestos-cement pipe products. Franklin Plastics, Inc. has been operating in the extruded pipe field for the last six years, producing and selling polyethylene, styrene, and ABS (acrylonitrile butadiene styrene) plastic pipe.

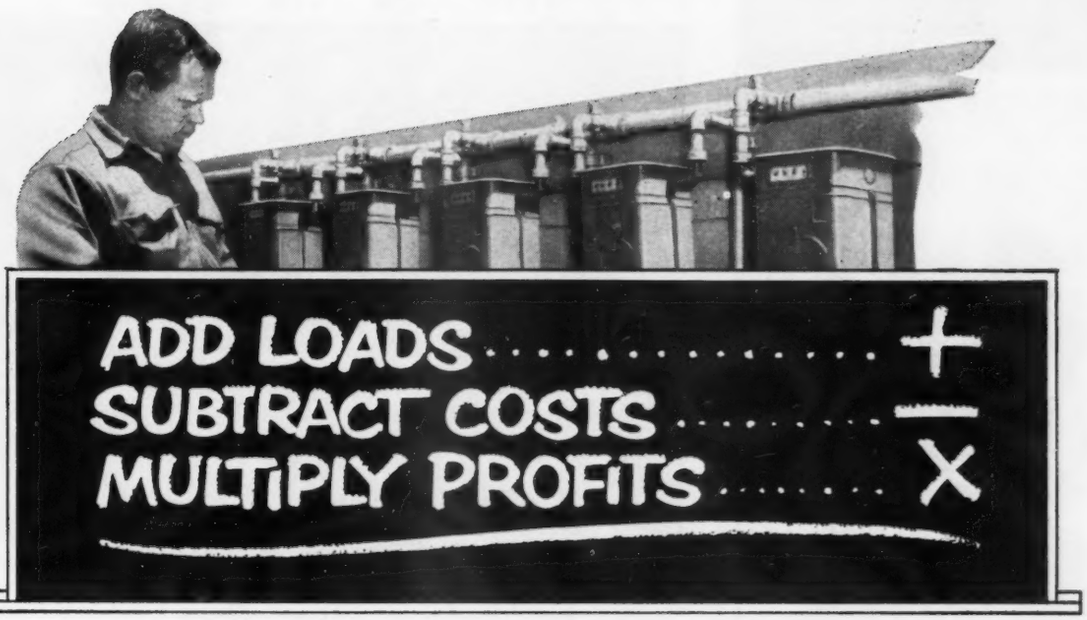
Fifth annual Appalachian Underground Corrosion Short Course is scheduled to be held June 1, 2, and 3, at West Virginia University, Morgantown, West Virginia. The course, which covers both technical and non-technical presentation of the practical and theoretical aspects of corrosion, will include 54 classes and a number of field demonstrations.

Pioneer Natural Gas Co., Amarillo, Texas, plans a two-for-one split of its common stock. The proposal will be submitted for approval at the annual meeting of the stockholders April 19. Company serves approximately 194,387 customers in the Texas Panhandle as far south as Midland, Odessa, and Big Spring. Subsidiaries include Amarillo Oil Co., Pioneer Production Co., producers of oil and gas, and Pioneer Gathering System operating in Val Verde, Sutton, and Schleicher counties, Texas.

Oklahoma Natural Gas Co., Tulsa, has purchased Standard Gas Co. serving the cities of Tishomingo and Madill in the Lake Texoma area in southern Oklahoma for an undisclosed cash amount. ONG took over operation of the new area in February, and plans to operate it as part of the Ardmore area of the company's Shawnee district. Acquisition of Standard Gas has added approximately 2000 customers to ONG's lines. James J. McLaughlin of the Shawnee district has been appointed manager of the newly acquired property. Clyde P. Bryant, formerly of Ardmore, will assist him in Madill, and B. J. Wellborn, formerly located in Wetumka, Oklahoma, will assist him in Tishomingo.



Shirtsleeved newsboy isn't bothered by freezing temperatures as he sells newspapers under warmth of infra-red radiant gas heaters recently installed in ceiling of Adams street entrance to the Peoples Gas Light and Coke building in Chicago. Heating engineers point out this new utilization of gas helps solve difficult industrial and commercial heating problems. Infra-red rays heat objects and not air, thus offering a practical method of meeting heat needs in airplane hangars, foundries, commercial garages, and other large area establishments.



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WELDED STEELCASE METERS BEST

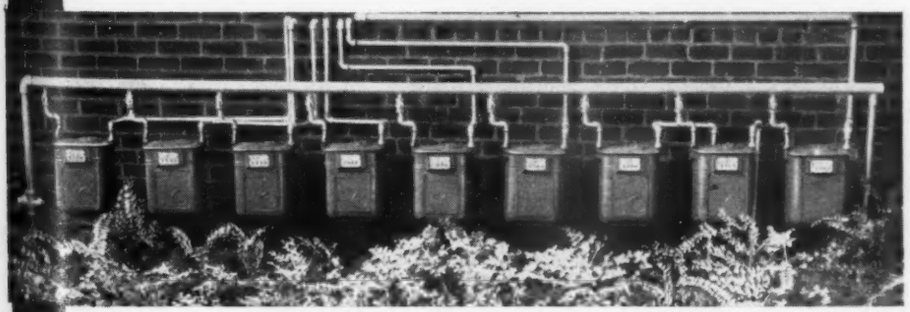
Modern American® Welded Steelcase Meters combine hard-case durability with proven tinned steelcase performance to provide a new approach to the economics of meter maintenance and retirement.

Low first costs – long-term maintenance savings. Major repairs eliminated – minor repairs and adjustments are easy to make assuring long service life.

Lifetime weather and corrosion resistant finish stays attractive in both indoor and normal outdoor settings. Special impervious coating for highly corrosive atmospheres also available.

Sustained accuracy is built into these meters with proven speed ratio and the many time-tested quality features and refinements pioneered by American in more than 120 years of meter engineering.

Ask your American representative about Welded Steelcase Meters and their many advantages for all fuel gas services.



American W-210 Welded Steelcase Meters in this Southern Alabama installation insure dependable, accurate measurement and long-term outdoor service without rusting.

W-210 Welded Steelcase Meter
Rated capacity 210 cfh for medium-sized homes with heating.

W-75 Welded Steelcase Meter
Rated capacity 75 cfh for average homes without central heating.

WC-45-LPG Welded Steelcase Meter
Rated capacity 45 cfh propane for average domestic services without heating.

AMERICAN®
METER COMPANY
INCORPORATED (ESTABLISHED 1836)

AMERICAN METER CO. EST. 1836 MEASUREMENT ENGINEERS

GENERAL SALES OFFICE: Philadelphia 16, Penna. • Albany • Atlanta • Baltimore • Birmingham • Boston • Chicago • Dallas • Denver • Houston Kansas City • Los Angeles • Minneapolis • New York • Omaha • Pittsburgh • San Francisco • Seattle • Tulsa • Wynnewood

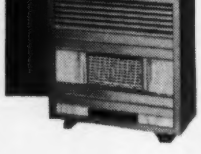
IN CANADA: Canadian Meter Company, Ltd., Milton, Ontario • Calgary • Edmonton • Montreal • Regina • Vancouver

SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves

EVERYONE'S A CUSTOMER FOR A **DEARBORN**

It's just what the doctor ordered to avoid chilling drafts... provides comfort for your customers in *any* condition. All your customers will agree, too, when you show them just a *few* of Dearborn's outstanding features — the famous Cool Safety Cabinet, Hi-Crown burner that's guaranteed for *life*, and, of course, the most stylish design in the industry. For good looks *and* good heating, Dearborn is tops!

THERMO-THRUST BLOWER



Puts a carpet of warm air across the floor, up to *twice* as much air delivery. Movable louvers allow directional warm air flow control. Standard on all Regency models.

The Dearborn Regency is the world's finest gas area heater. Lower, longer and loaded with sell-on-sight appeal!

Dearborn®

Get details of Dearborn's clean-cut selling policy from any of these regional sales offices: Atlanta, Chicago, Dallas, Los Angeles, San Francisco.

1960 Dearborn Stove Co., Dallas

Newsreel

100,000th Gas House-Heating Customer added to Philadelphia Electric Company lines. Carmine A. Donafrio, eastern division gas, unloads the new meter to be set in the home of Mrs. A. G. Yerkes in Willow Grove, marking a new record in company growth. About half of Philadelphia Electric's residential gas customers use gas for heating their homes, compared with less than 10 percent in 1948.

Deere & Company and Boothe Leasing Corporation have announced a nationwide plan for leasing John Deere industrial tractors and equipment. The plan, believed to be the first of such wide scope and type, will operate through the John Deere dealer organization and be limited to the Deere's industrial and commercial customers. Manufacture and sales of industrial tractors and equipment has been one of the new avenues of growth Deere has been investing in in recent years; last year company recorded $48,000,000 in industrial sales, an 82 percent increase over 1958. Headquartered at San Francisco, Boothe is one of the largest U. S. firms specializing in leasing of industrial equipment and business machines. The new leasing plan is seen as a dealer "sales tool" supplementing the John Deere credit plan under which a customer purchases equipment outright on time payments.

Michigan Gas Utilities Co., Coldwater, Michigan, plans to split the company's common stock two for one. Shareholders will be asked to approve the step at the annual meeting May 17. Company serves approximately 35,000 customers in 23 communities.

Fort Smith, Arkansas, has been selected as the site for a new million square feet modern, one-story plant for Norge Division, Borg-Warner Corporation. The new plant, estimated to cost in excess of $10,000,000, will accommodate from 1500 to 2000 employees and will be used to manufacture Norge's new gas refrigerator and other gas appliances together with new products being developed; also to build and fabricate other appliance components. Fort Smith, was selected, said Judson S. Sayre, Norge president, as the most desirable location for this new development, not only because of a favorable business climate, but also in view of the expanding south and southwest market, anticipated growth in this general area, and a shifting population center that will determine future consumer purchasing trends and efficient distribution.

Panellit, Inc. and its affiliate Information Systems, Inc., have approved proposals at special stockholders meetings that will permit Chance Vought Aircraft, Inc., to acquire a majority of Information Systems' stock. Proposal provides for the liquidation of Panellit and sale of its assets to Information Systems for $3,750,000. Following completion of the sale scheduled for mid-March, Chance Vought subsequently will acquire approximately 80 percent of Information Systems' common stock for $61,000,000. In addition, Information Systems will receive all the outstanding stock of Genesys Corp., a wholly owned subsidiary of Chance Vought. Panellit and I.S.I. are engaged in production of automatic control systems for various manufacturing processes. Genesys produces process control systems and special purpose digital control computers and recording devices.

Frank Sinatra and Gas Genie starred on the premiere TV "spectacular" sponsored by The Canadian Gas Association as part of its PAM program to boost acceptance of natural gas in Canada. Commercials on the show featured the Gas Genie and an institutional message that plugged benefits of natural gas to the Canadian economy. CGA plans a series of similar "spectaculars" during 1960 over the 42-station CBC network to get national coverage. Stars on the first spectacular, besides Sinatra, included Lena Horne and Mary Costa.

MEN AT WORK

IN THE GAS DISTRIBUTION INDUSTRY

● **Harry P. Letton, Jr.,** has been elected vice president and general counsel for the Southern California Gas Company succeeding **T. J. Reynolds.** Letton was formerly general attorney.

H. P. Letton, Jr.

F. M. Rudman

● **Francis M. Rudman** has been appointed superintendent of the street department of Michigan Consolidated Gas Company. He was formerly general manager of the company's Northern districts.

● **John F. Merriam** has been elected to the newly-created position of chairman of the board and president of Northern Natural Gas Company. His former position was president. **Max A. Miller,** director of Northern for 17 years, has been named to the newly-created position of vice chairman of the board of directors.

● **R. Melvin Hunter** has been appointed director of public relations and industrial development for Northern Ontario Natural Gas Company Ltd. and Twin City Gas Company Ltd. He was formerly general manager of Twin City Gas Company.

● **F. Irving Yewman** has been appointed general manager of Twin City Gas Company Ltd. He was formerly general sales manager of Lakeland Natural Gas Company Ltd. in Kingston, Ontario.

● **George R. Woehler,** vice president and comptroller of Southern Indiana Gas and Electric Company, has been elected a director of the company succeeding **Edmund F. Ortmeyer.**

● **Harold P. Rodes,** president of Bradley University, and **Q. W. Wellington,** vice president of operations for Central Illinois Light Company, have been elected to the board of directors of Central Illinois Light succeeding **T. A. Schlink,** former chairman of the board, and **C. V. O'Hern,** Peoria attorney. **E. D. Edwards** has been re-elected president of the company and additionally chairman of the board succeeding T. A. Schlink.

● **Dan E. Karn** has announced he will retire April 30 as president of Consumers Power Company. **Alphonse H. Aymond, Jr.,** now executive vice president, will become chairman of the board and chief executive officer. **James H. Campbell,** now senior vice president, will become president and chief operating officer. Karn will continue with the company as a consultant, and will become chairman of the finance and budget control committee, succeeding **Justin R. Whiting,** former chairman of the board and president, who will retire from this chairmanship.

● **Stephen H. Baer** has been appointed to head personnel functions of Pacific Lighting Gas Supply Company in addition to his public relations duties. His title will be public relations and employee relations director.

● **George B. Tuggle** has been named senior vice president of Honolulu Gas Company, Ltd., succeeding **L. Lyman Gowans,** retired. Gowans, who retired last year, continues to serve as a member of the board.

● **James F. Fairman,** senior vice president, Consolidated Edison Company of New York, has been selected to receive the 1960 National Society of Professional Engineers Award for outstanding service to the engineering profession. Formal presentation will be made early in June at society's annual meeting.

● Consumers' Gas Co. of Toronto has announced the appointment of **John M. Gifford** as personnel director for the company and its affiliates. He was formerly with Catalytic Construction of Canada in Sarnia, Ontario. **Andrew A. Mitchell** has been appointed staff assistant to **W. Kelly,** general superintendent of distribution. Mitchell was formerly with the Glasgow and Western Division of the Scottish Gas Board.

● **William R. Pringle,** secretary of The East Ohio Gas Co., has been named head of a newly-established area development department. As area development manager, he will direct Ohio's efforts to attract new industry to northeastern Ohio, and implement and coordinate the new area development program of Consolidated Natural Gas Co., parent firm of East Ohio.

● **Miss Frieda Barth,** director of home service for Michigan Consolidated Gas Co., has been named executive advisor in the home service division. **Miss Peggy Lewis,** who is completing 10 years with the utility, has been appointed director of home service, **Miss Irene Hickey,** former director of the division and an executive advisor, is retiring.

● Directors of Northwest Natural Gas Co. have elected **Patrick B. O'Rourke,** assistant vice president. He will continue as general operating manager, a post he has held for eight years.

R. H. Willis

R. C. Foster

◒ Stone & Webster, Incorporated, has elected **Raymond C. Foster,** and **Robert H. Willis,** vice presidents of the firm. Both had been assistant vice presidents since May 1959.

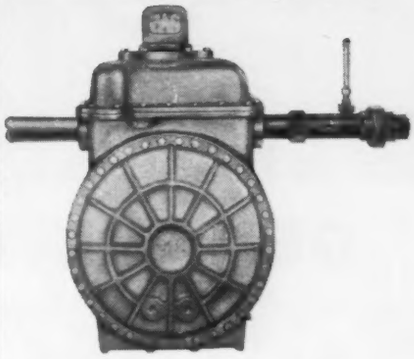
◐ **Wallace P. Miller** has been named manager of two-way radio sales for the midwestern states for Motorola Communications & Electronics, Inc. **John F. Fussell** succeeds Miller in his former New York sales post.

● Middle West Service Company has opened offices in Washington, D. C. and appointed **Harold E. Marmaros** as resident manager for the new offices.

new

AMERICAN®

1000 psi working pressure critical flow prover



Designed for 1000 psi maximum working pressure, the new American® Critical Flow Prover provides economical proof testing of high pressure displacement meters in the field. The portable, precision-engineered design meets the highest standards of accuracy and dependability.

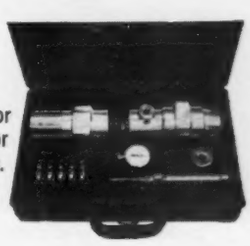
Available in 2-inch size with gas capacities from 250 to 6000 cfh. Each orifice individually calibrated.

SAVES MONEY
no costly set and removal expenses.

SAVES TIME
proof tests conducted on-the-spot.

SAVES EFFORT
no handling or transporting meters to the shop.

ASK your American representative for Bulletin 203.1 for complete details.



AMERICAN® METER COMPANY
INCORPORATED (ESTABLISHED 1836)

General Offices: Philadelphia 16, Pa.
Sales offices in principal cities

GET YOUR PIPE IN A QUALITY LINE

YES, QUALITY PIPELINE BY LATEX

LATEX offers to clients fast, efficient, quality service in unraveling their pipeline problems. Call on the company that has brought repeat business back again and again for over a quarter of a century.

Another service of *LATEX* is PRODUCTS PUMPING STATIONS. *LATEX* has years of experience in this type of installation.

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SERVING 1/4 CENTURY

LATEX CONSTRUCTION COMPANY

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Men at Work

H. A. Dietrich

A. P. Gallagher

● Burgess-Manning Company has announced the following personnel changes in its industrial silencer division: **H. A. Dietrich,** vice president and manager of the industrial silencer division, has been transferred to Dallas from Libertyville, Illinois, former headquarters of the division. **A. P. Gallagher** has been promoted from chief engineer to engineering coordinator in Dallas; **Edmund J. Halter** has joined the company as chief development engineer in charge of the division's research and development program in Dallas; **Bill Golden** has been promoted to chief application engineer; **Carl Read, Jr.,** former office manager in Dallas, has been appointed advertising manager. **R. J. McCormick,** former coordinator for Libertyville division, has been transferred to Dallas and promoted to senior sales coordinator.

● **O. L. Liepin** has been promoted to heating and air conditioning account executive for the General Controls' eastern region. Liepin's new duties include selling domestic heating controls for residential use and General Controls' line of air conditioning controls at the original equipment manufacturer level.

● **A. A. Steinle, Jr.,** former district supervisor, has been promoted to staff assistant to the vice president in charge of operations at Heath Survey Consultants, Inc., leakage survey experts serving gas utilities nationally.

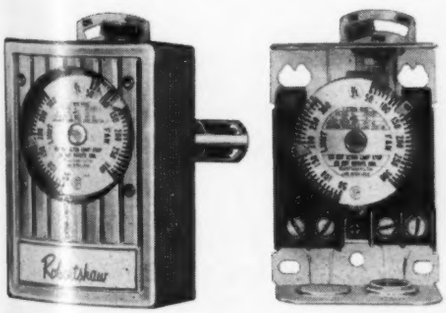
● **DeWitt A. Forward** has been elected a director of American Natural Gas Company. Until his retirement on October 1, 1959, Forward was a director and vice chairman of the board of the First National City Bank of New York.

W. K. Menke

Henry Avery

● Pittsburgh Coke & Chemical Company has consolidated its three chemical divisions — protective coatings, activated carbon, and industrial chemicals divisions — into a new, wholly-owned subsidiary company, Pittsburgh Chemical Company. Officers of the new company are: **W. Kenneth Menke,** president; **Henry Avery,** executive vice president; **Jonathan C. Cooper,** vice president and general manager of the activated carbon division; **Arthur E. Gray,** vice president and general manager of the protective coatings division; and **Duncan J. MacLennan,** vice president and general manager of the industrial chemicals division.

All new, full-load Fan and Limit Switch offers you more new features!



Newest of the new controls we promised you in 1960—the Robertshaw *full-load* (¾ hp-14 amp.) Fan and Limit Switch incorporates many new engineering ideas to save you inventory and installation costs . . . to give you and your customer the ultimate in reliability! Check these exciting new features—Color coded dial settings and terminals, high no-short terminal barriers, element temperature indicator, single helical element, no-creep temperature set, 2-second limit lock or stop, "add-on" summer fan switch, "no-bounce" self-cleaning switch—roller actuator for consistent and smooth operation, protectively enclosed switches, interchangeable mounting, snap-on hammer-tone gray finished cover—available in four standard element lengths and many model combinations. FOR MORE INFORMATION CONTACT:

Robertshaw

MR. CONTROLS

ROBERTSHAW-FULTON CONTROLS COMPANY

GRAYSON CONTROLS DIVISION Long Beach Boulevard, at Long Beach Freeway

Men at Work

● The Grabler Manufacturing Company, Cleveland, manufacturers of pipe fittings, has appointed **John S. Evans** as manager of their Minneapolis, Minnesota branch.

J. S. Evans

H. T. Stroop

● Whirlpool Corporation has appointed **H. Thomas Stroop** to the newly-created position of sales manager for gas refrigerators. Formerly sales supervisor, refrigeration division, Stroop will be responsible for sales activities relating to the gas refrigerator in coordination with firm's utility division and through the regular field sales organization of Whirlpool.

● Geo. D. Roper Sales Corporation has announced the following personnel changes: **W. J. Foster** has been appointed vice president and director of sales; **Harry Sahlin,** formerly comptroller of David Bradley Mfg. Works, has been appointed controller.

● **Francis A. Curry** has been named community relations assistant in Rockwell Manufacturing Company's public relations department. He was formerly headquarters personnel manager.

● Union Switch & Signal Division of Westinghouse Air Brake Company has appointed four sales engineers as area representatives in sales involving pipeline control systems and equipment in the U. S. and Canada. **Gerald M. DuBois** has been designated eastern area representative; **Robert J. Cook,** midwestern area representative; **William F. Haley,** southwestern area representative; and **James H. Stelloh,** western area representative.

● **Charles Carter** has been appointed district manager in the New York region for Grove Valve and Regulator Co. He will direct sales in the Middle Atlantic and New England states, from headquarters in New York City.

● **Frank C. Packer** has joined the staff of Regent Jack Mfg. Co., Inc. to promote the company's line of pipe squeezers.

● **Jean Raymond,** Q. C., president and general manager of Alphonse Raymond, Ltd., has been elected to the board of directors of Quebec Natural Gas Corporation succeeding **Joseph A. Page.**

● Union Malleable Manufacturing Co. has announced the following appointments as sales representatives: In the East South Central area, Cosper Co., Inc. of Birmingham, Alabama; in Florida, S. F. Holcombe, Jr. of St. Petersburg; and in North Carolina and in central and southern Virginia, West Howell of Charlotte, North Carolina.

● Computer Measurements Co. of Sylmar, California, manufacturers of pipe and pipe-leak detectors, box and valve detectors, has announced a new utility representative, Overton Sales-Equipment Co. of San Diego who will market their line of Detectron utility instruments.

● Burgess-Manning Company has announced three promotions and a new assignment in the industrial silencer division: **Louis G. Halla** has been promoted from sales engineer to manager of the western district sales offices in Los Angeles; in the southern district sales office in Dallas, **H. L. Harris** is the new manager, and **G. R. Packer,** former sales coordinator, is now a sales engineer; **Albert J. Stella, Jr.,** has joined the company as sales engineer in the eastern district sales offices in New York City.

● **L. R. Mobley** has been appointed sales representative in the southeast for Southern Pipe Coating Company.

● Siegler Corp.'s Holly-General Division has established four new sales districts and appointed a vice president to head each of the new district sales offices in Dallas, San Francisco, Los Angeles, and San Diego. **Leroy D. Nutter** will be in charge at the Dallas office; **Earl C. Hefner,** the San Francisco office; **John F. Droge** in the Los Angeles office, and **Jackson L. Garner** in the San Diego office.

● **Edgar G. Murphy** has joined Selas Corp. of America, Dresher, Pennsylvania, as marketing assistant. He will be responsible for preparation of industrial publicity, advertising, and sales promotion literature, concerning the use of Selas heating equipment in the processing of metals.

● **Richard R. Rue** has been appointed plant manager of Insul-Mastic, Inc., Pittsburgh Coke & Chemical Co. subsidiary that produces asphaltic mastics and insulating coatings for sale through the parent company's protective coatings division. Rue was formerly director of research for Insul-Mastic.

1897 1960

GOODMAN GAS MAIN STOPPER
Used since 1897
Improved Locking Sleeve

PIPE STOPPERS OF ALL KINDS

•

SAFETY GAS MAIN STOPPER CO. INC.

523 Atlantic Avenue
Brooklyn 17, N. Y.
Cable Address: GASTOPPER, N. Y.

SAFETY BY SURVEY

Vegetation Method, Safety, and Combination Surveys increase the safety factor of distribution systems.

SAVINGS BY REPAIR

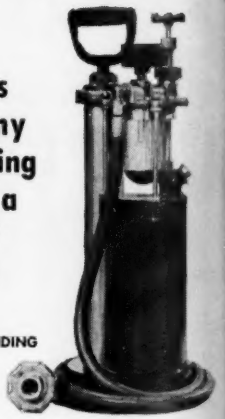
Fully equipped, thoroughly trained SCF crews are on call to repair the leaks found — saving gas, without costly build-up of equipment and personnel by the operating company.

SERVICE BY SOUTHERN CROSS FORESTERS
Atlanta 6, Ga. ME 4-4227

DRAGNET leak detector

detects and locates leaks on any pressure piping system in a matter of minutes!

PATENTS PENDING

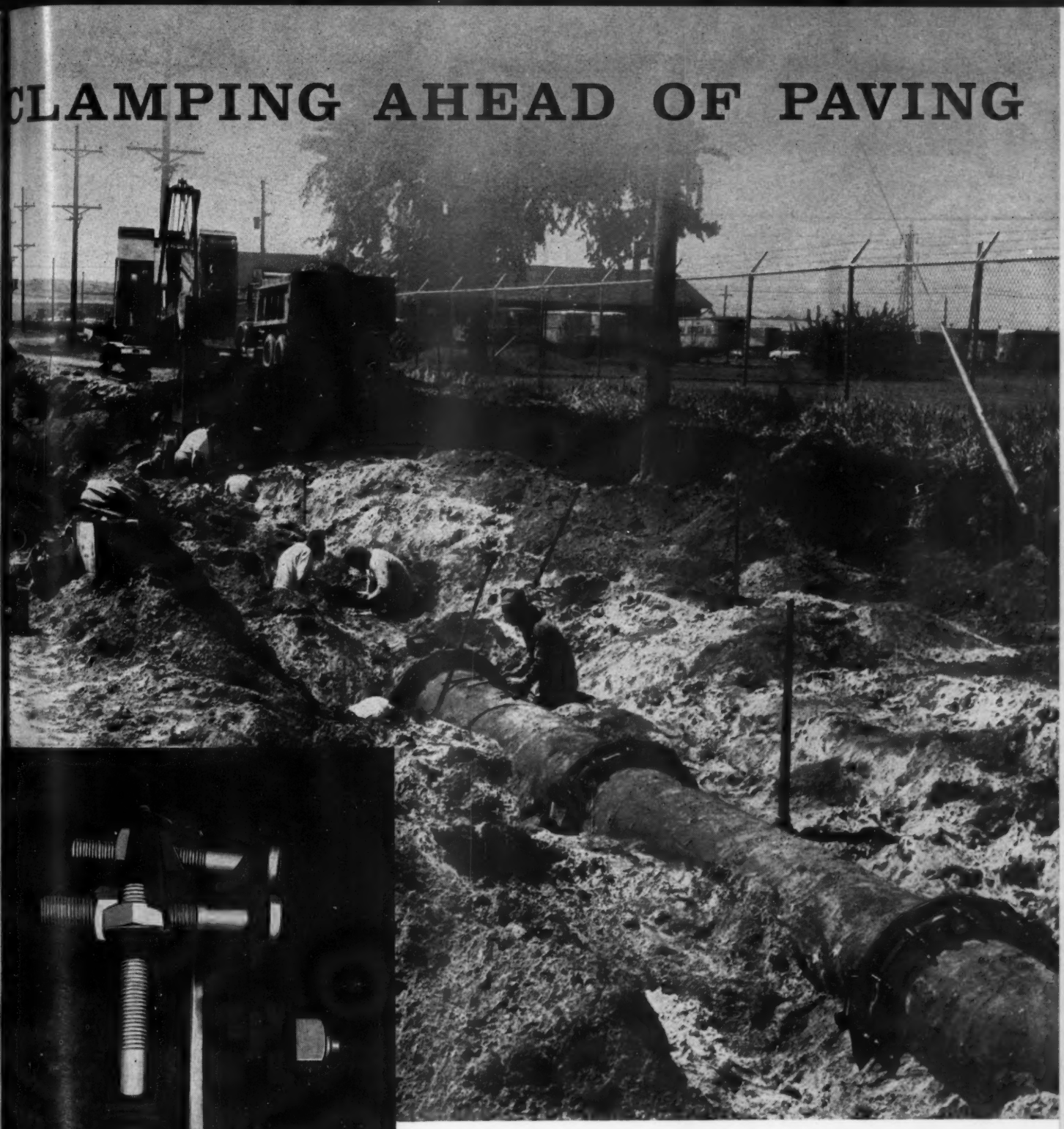


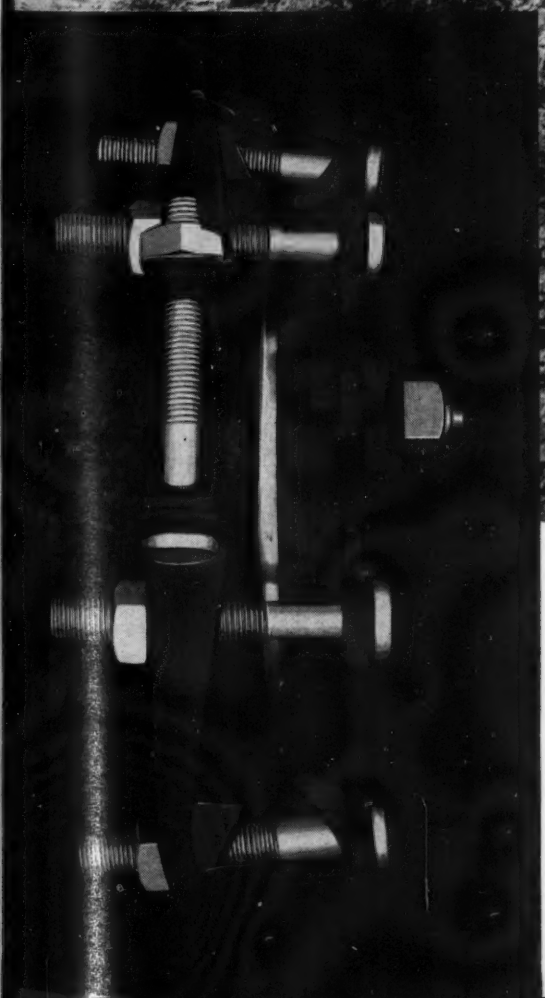
Here's the newest time-saver in the industry! The compact, portable Dragnet Leak Detector will detect even the tiniest leak on any pressure piping system for gas, steam, water or refrigeration. Unique "bubble action" principle much faster than by using pressure gauge or manometer.

SEND FOR BULLETIN 545

UNIVERSAL CONTROLS CORPORATION
P. O. Box 13122
Walnut Hill Sta. — Dallas, Texas

CLAMPING AHEAD OF PAVING





More and more, clamping bell and spigot joints ahead of paving is becoming standard practice around the country.

When you clamp with the Skinner-Seal Bell Joint Clamp, you get massive malleable iron construction, gaskets sealed by stainless steel band, oversize corrosion-resistant bolts.

For over 50 years, our clamps have been built for permanence. Every detail of design and construction is worked out with that in mind.

M. B. SKINNER CO., SOUTH BEND 21, IND.

SKINNER-SEAL BELL JOINT CLAMP

Naugatuck KRALASTIC®

No waste of time, materials, and money with **KRALASTIC**

There's no need to protect this original ABS pipe from corrosion because KRALASTIC *can't* corrode. There's no need for expensive hoisting and laying equipment because KRALASTIC weighs less than aluminum. Pipe made of KRALASTIC can be loaded, unloaded, carried, and laid by hand. (Consider the safety advantages alone!)

Other advantages? KRALASTIC offers many. Its smooth internal surfaces offer less flow resistance. KRALASTIC pipe can be "welded" with a sleeve fitting and a special solvent. Yet where desired, it can be threaded and made up with standard KRALASTIC valves and fittings. Its unique combination of hardness and extreme toughness protects it against damage from foreign objects in the soil. Yet it can be easily cut to length with a hacksaw.

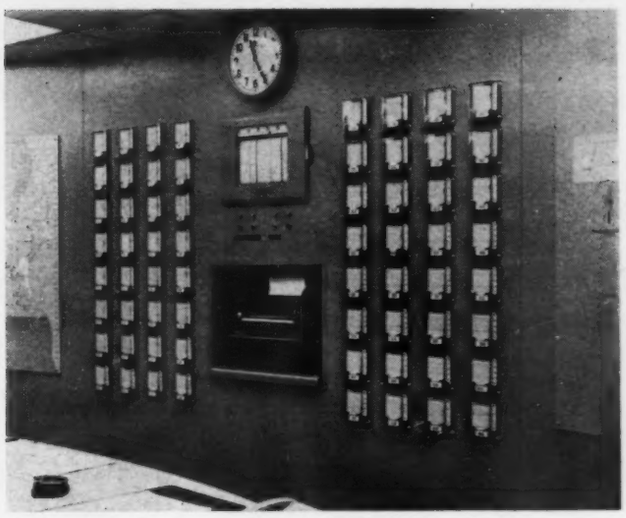
There are many more advantages to pipe made of KRALASTIC... advantages that have led to and been proved by more than 10,000 miles of pipe installed for everything from potable water to oil, brine, chemical, gas, and electric lines. Discover the advantages of this NSF Approved piping material yourself.

United States Rubber
Naugatuck Chemical Division
DEPT. 552K ELM STREET
NAUGATUCK, CONNECTICUT

KRALASTIC RUBBER-RESINS • **MARVINOL** VINYLS • **VIBRIN** POLYESTERS

Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Phila. · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.

New dispatch center boasts increased size and efficiency. Graph on glass wall behind dispatcher compares daily sendout of past two years.



Nerve center of the dispatch office is the central board. Instruments mounted on the panels are kept under surveillance 24 hours a day.

Milwaukee Gas Light aims for peak efficiency with a . .

Fully Instrumented Gas Dispatch System

New facilities include a computer system to measure gas flow at gate stations, an analog telemetering system, high-low alarm system, and industrial metering instrumentation for interruptible load control . . . all in one integral unit

John A. Brady, *Manager, Gas Supply, Milwaukee Gas Light Company, Milwaukee, Wisconsin*

ANTICIPATING CONTINUED GROWTH IN ITS NATURAL GAS SUPPLY and sendout, Milwaukee Gas Light Company has modernized and expanded its gas dispatching facilities.

Since the introduction of natural gas to Milwaukee in 1949, the company has been purchasing gas from Michigan Wisconsin Pipe Line Company on a straight commodity form of rate. The impending introduction of a demand-commodity rate by the pipeline supplier accelerated installation of the new equipment.

The new facilities, while designed to operate as an integral unit, are composed of four basic phases. A *computer system* measures natural gas flow through five company gate stations. Pressures, temperatures and other gas flow information are indicated on an *analog telemetering system*. Other phases are a *high-low alarm system* for monitoring pressures at remote locations and *industrial metering instrumentation* for interruptible load control.

Flow Measurement System

The flow-measurement system consists of individual computers that calculate gas flows at each of the five gate stations. The readings are corrected for temperature, pressure, supercompressibility and specific gravity. These corrected flows are transmitted to the gas dispatch center in downtown Milwaukee as analog signals to a graphic receiver and as separate digital signals recorded on a teletypewriter.

The flow measurement sub-system for each gate station consists of two or more flow transmitters, a static pressure transmitter, a temperature bulb, and a computer totalizer.

The flow transmitters are provided with ranges to measure the gas flow from each orifice as follows:

Station	*Range*
Menomonee Falls	3 ranges
Capitol Drive (Brookfield)	2 ranges
Milwaukee City Gate	3 ranges
Hartford	5 ranges
West Bend	5 ranges

Pressure correction is made to a standard pressure of 14.735 psia over the ranges as tabulated:

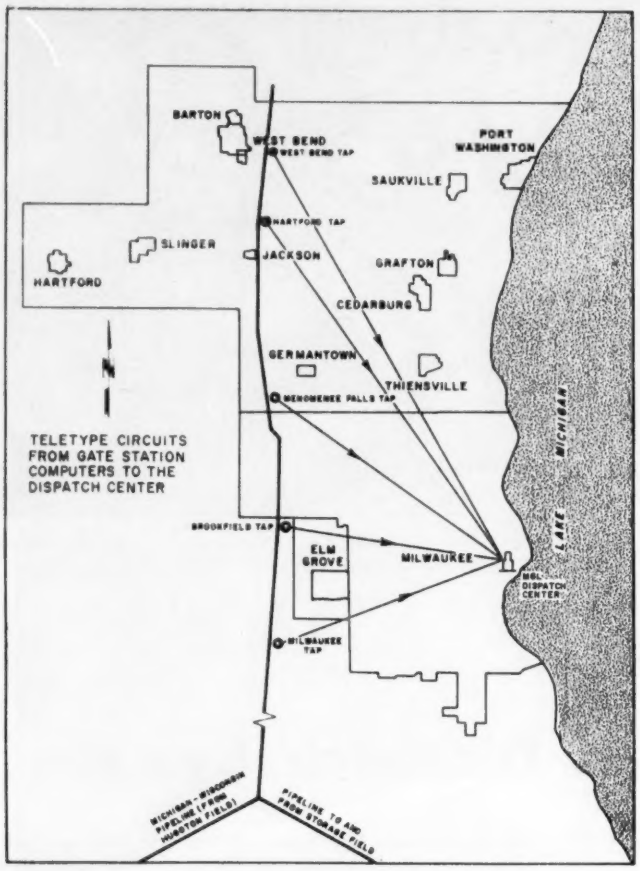
Station	*Range*
Menomonee Falls	0 to 550 psig
Capitol Drive (Brookfield)	0 to 800 psig
Milwaukee City Gate	0 to 350 psig
Hartford	0 to 300 psig
West Bend	0 to 350 psig

Temperature correction, to a standard temperature of 60 F, is accomplished by a resistance temperature bulb located in the downstream manifold.

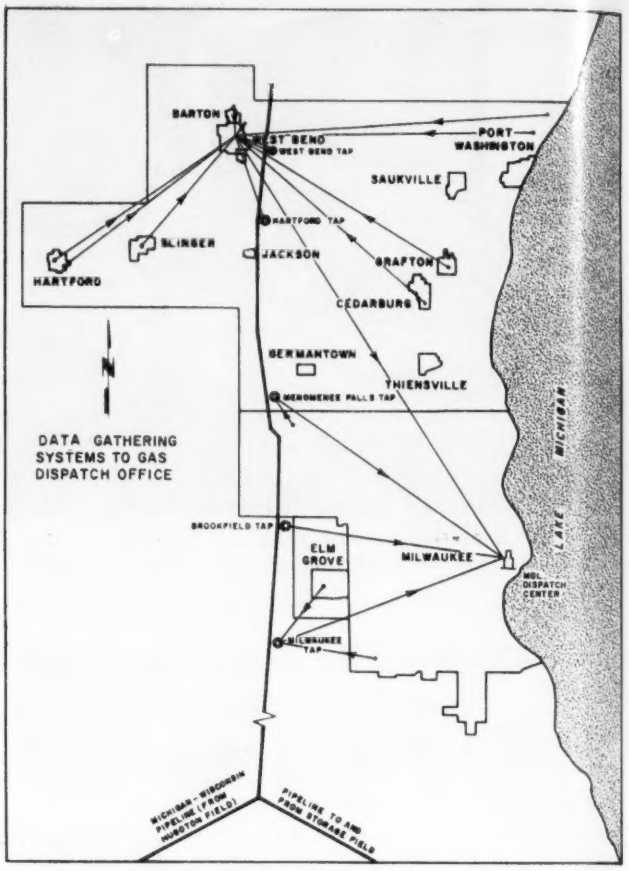
Each computer totalizer is provided with a manual control for continuously adjusting specific gravity over a range of 0.6 to 0.75. A similar control adjusts supercompressibility over a range of 1.00 to 1.10.

Each totalizer is equipped with range change switches for manual selection of ranges as follows:

Station	*Range (MSCF per Hour)*
Menomonee Falls	1000-2000-4000-8000
Capitol Drive (Brookfield)	2000-4000-8000-10,000
Milwaukee City Gate	2000-4000-8000-10,000
Hartford	40- 100- 200- 400
West Bend	100- 200- 400- 800



Teletype circuits from gate station computers to dispatch center. Individual computers at each station calculate flow data that is read out at dispatch center on both teletypewriter and graphic receivers.



Data gathering system helps minimize communication circuit costs. Diagram illustrates how data from various points is fed to four gathering points, then relayed to dispatch center.

The computer totalizer also provides a slidewire output for a rate-of-total-flow measurement, a second slidewire output for odorizer control, and an output shaft that connects to an integrator and digitizer for the digital telemetering equipment.

The system is also provided with a downscale failsafe feature. If the transducers or totalizer fail, the servo system will drive downscale, resulting in zero readout.

Hourly integration of the computed flows is provided and the integrator at each gate station is reset to zero upon completion of the hourly readout from that station.

Digital Telemetering System

The digital telemeter system transmits the flow signal from each gate station area to the dispatcher's office. A single enclosure houses the totalizer computer and the telemeter transmitter. The output shaft of the analog computer is coupled to an integrator that accumulates data and an encoder that closes various electrical contacts according to computer shaft position.

These contact closures energize a system of relays located in a translator to produce the correct digital code, according to shaft position; a teletype transmitter transmits the digital signals to the dispatcher's office for readout by a teletype printer.

Flow values received from each station are printed by the teletypewriter on a programmed basis. Printing occurs at 5, 15, 30 or 60-minute intervals as determined by the dispatcher. Demand readout may be obtained at any time by pushing a demand-readout button.

As protection against a communication circuit failure, visual readout counters have been installed on the computers at each gate station. In an emergency, a field employee can be sent to the gate station to relay the flow information by radio to the dispatch center.

Analog Telemetering System

A second phase of the system provides for an analog telemetering system to record signals from pressure, temperature and flow measurement transducers in the field.

To economize on communication circuit costs, gathering equipment has been located in four outlying areas. This equipment gathers readings on a time-cycle basis and transmits them over a single communication circuit to the dispatch board where they are separated and recorded.

The gathering equipment consists of a transmitter located in the gate station area and a receiver at the dispatcher's office.

The analog transmitter accepts a signal of from 1 to 5 volts proportional to the temperature, flow or pressure being measured. These signals are fed to the analog transmitter by phone line from various points in the surrounding area.

The telemeter receiver mounted in the graphic panel at the dispatcher's office scans the transmitted signals and is read out by miniature recorders mounted on the panel.

Twenty-seven readings are presently being transmitted from outlying locations to the dispatch center through four gathering systems. Location of these gathering points and their data sources are indicated in an accompanying diagram. To facilitate further expansion, the equipment at each gathering point is capable of transmitting up to 30 signals over its circuit.

In addition to the information re-

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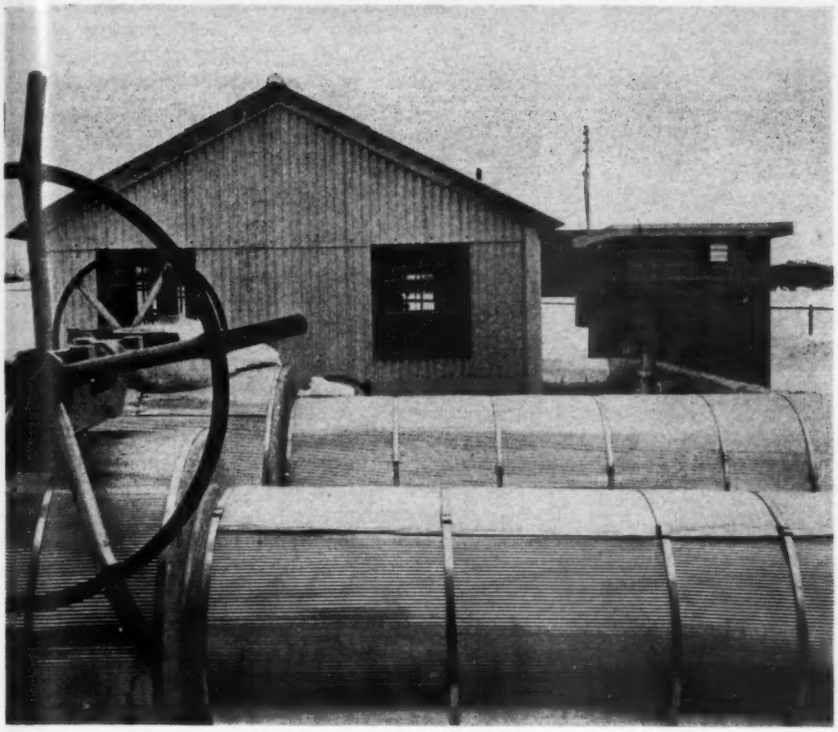
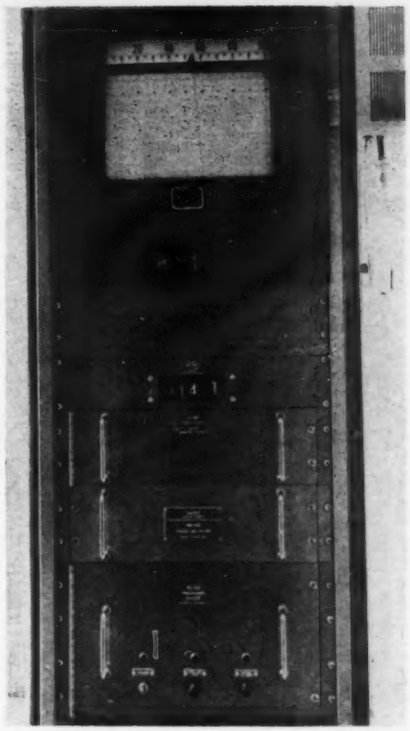


Special buildings were constructed at the gate stations to house gas dispatch instruments. Small building at right is at Menomonee Falls gate station.



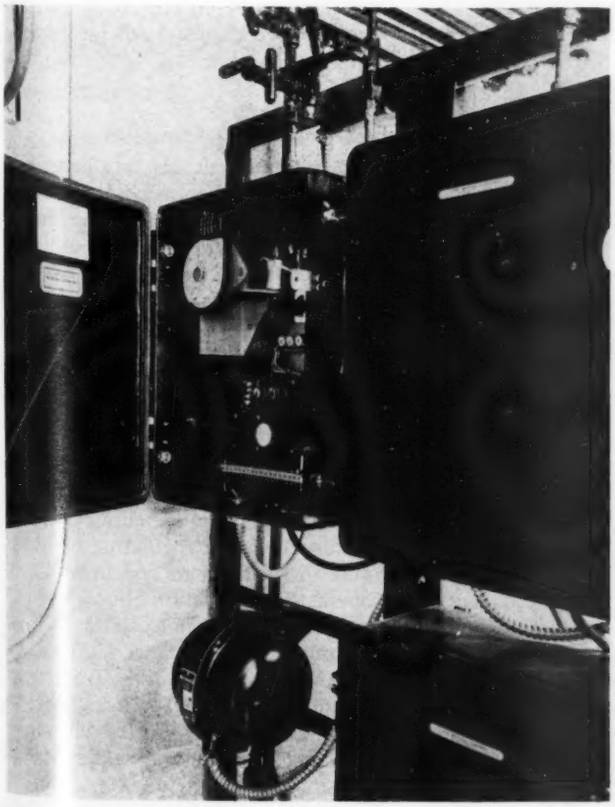
Typical computer module is illustrated by equipment in the Menomonee Falls instrument building.

ceived from the gathering systems, approximately 40 additional pressure and temperature readings reach the board on individual circuits and are recorded. Economy of operation determines whether a circuit is to be included in a gathering system or sent direct.

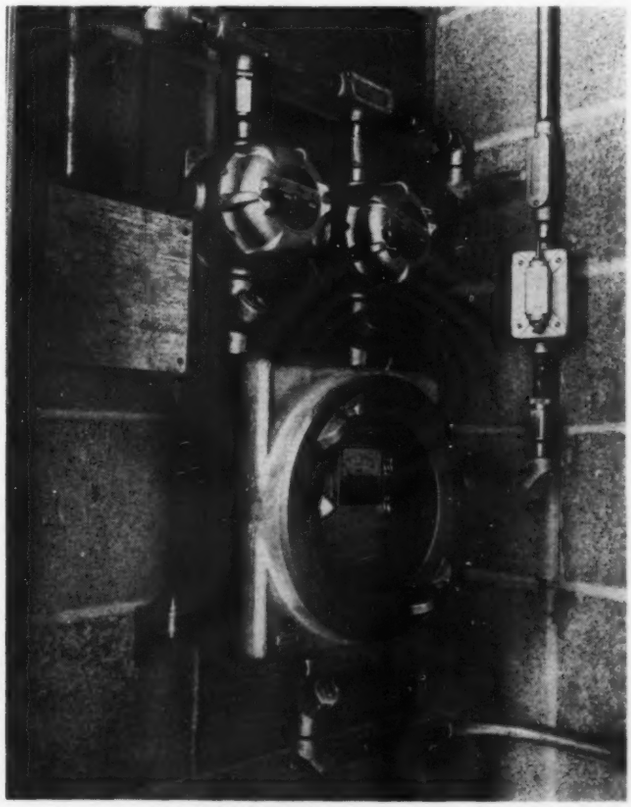
Transducers

The pressure transducers used in the instrumentation system are of the pulse length and variable current types.

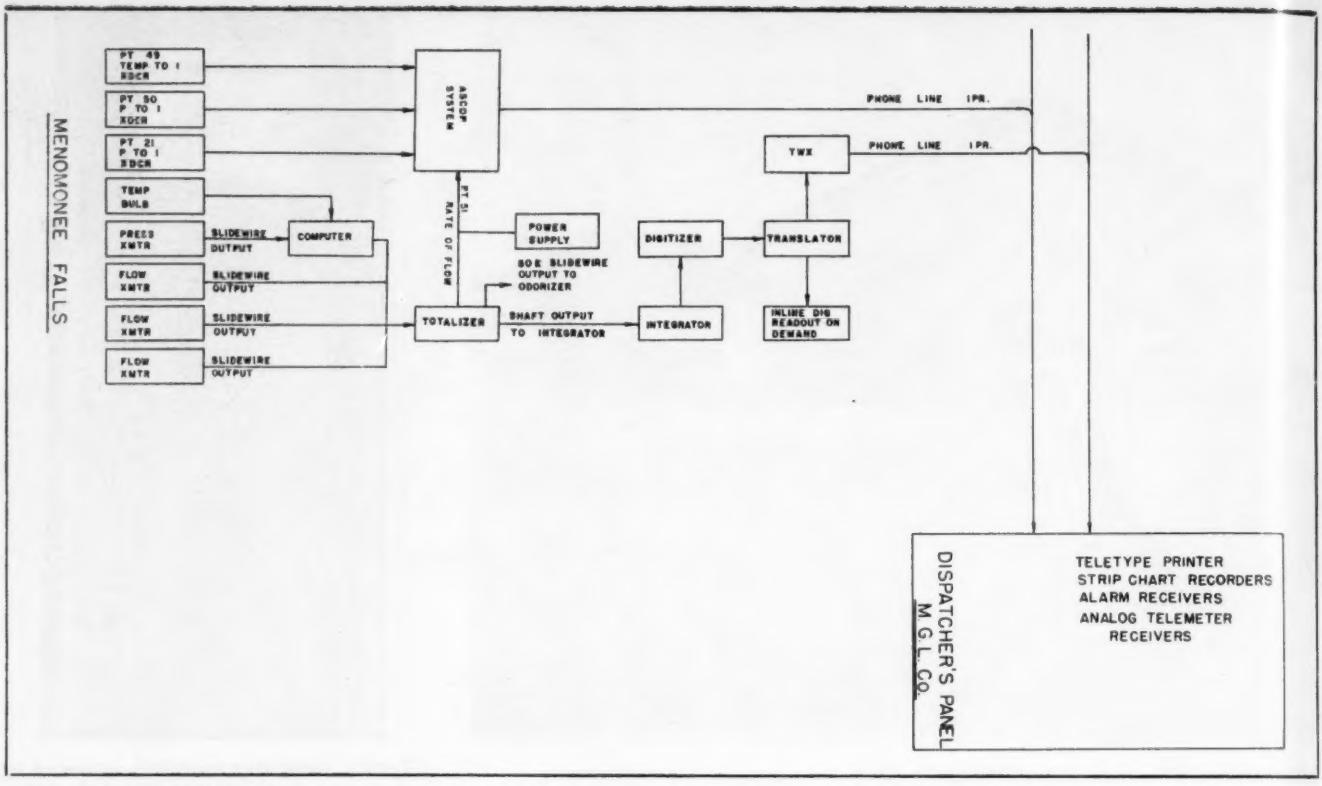
Four temperature transducers are used in the system. Each transducer uses a resistance bulb as the primary



Primary flow transmitter in gate station instrument building.



Gas detection system signals dispatcher if air/gas mixture reaches predetermined alarm setting.



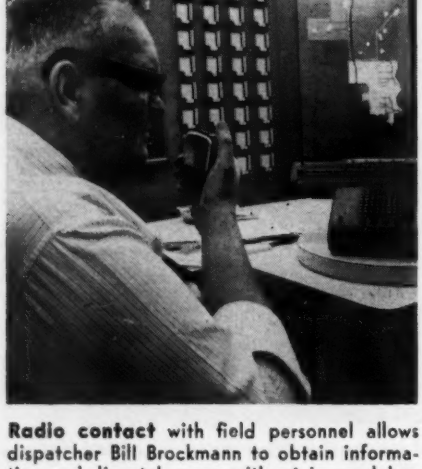
Typical instrumentation circuits are illustrated by block diagram of Menomonee Falls station equipment and tie-in to dispatch center.

element, which is installed in a well mounted in the gas transmission pipe. The transducer provides a signal output of from 1 to 5 milliamperes proportional to the gas temperature.

A temperature transmitter and a resistance bulb are provided for the weather measurement station. This is a pulse length type transmitter and the signal is transmitted via telephone line direct to the dispatcher's office. The temperature is read on a receiver installed in the dispatch panel.

High-Low Alarm System

A high-low alarm system monitors areas of the distribution system that are not covered by pressure measuring and recording equipment. If pressures at a specific site deviate from predetermined pressure settings, an alarm notifies the dispatcher. This system is utilized in situations where temporary pressure problems are known to exist, but which will be corrected within a reasonable period of time.



Radio contact with field personnel allows dispatcher Bill Brockmann to obtain information and dispatch crews with minimum delay.

Customer Gas Flow Data System

The final phase of the system is designed to provide gas flow information from the gas meters at large-volume industrial interruptible customers' plants. This information is a basic requirement for operation under the demand-commodity form of rate. To effectively monitor customers during periods of curtailment, Milwaukee Gas Light is studying several different instrumentation systems to provide the necessary flow information to the dispatcher.

In one system, a rate-of-flow signal generated by a magneto at the meter is transmitted to the multipoint receiver at the dispatch board. This receiver is capable of recording signals from as many as twenty-four customers on the same chart. It provides a visual indication as well as a permanent record of the customer's observance of a curtailment request.

A second system under consideration is a pulse generating system that transmits flow information directly from the industrial customer's meter to the remote reading index at the gas dispatch center. This index, though providing a visual readout, does not offer a permanent record of the customer's activities. Further studies are being made of the possibility of printing these readings on the teletypewriter during idle time or of cutting IBM cards to record the volumes. Such information would also be useful in future load studies.

Instrument Buildings

Separate instrument buildings have been constructed at each gate station to house the computing equipment and other instruments. Metering and regulating buildings with their extreme temperature conditions and limited space are not ideally suited to accurate operation of this equipment. The instrument buildings are heated and provide facilities for field maintenance of the instruments.

At Hartford and West Bend gate stations, separate instrument buildings, located near the pipeline company measurement and regulating buildings, house the instrument system field components. Each location houses two flow transmitters and one static pressure transmitter, the computer totalizer, and the digital telemetering transmitter. The analog telemetering gathering equipment is located in the Milwaukee Gas Light Company sales office at West Bend.

West Bend sales office also acts as a gathering point for signals from seven

field locations. These signals are fed into receivers equipped with re-transmitting slidewires and then into the analog telemetering system.

At Menomonee Falls gate station, a separate instrument building located near the pipeline company building houses the gas dispatching system instruments. This equipment consists of three flow transmitters, a static pressure transmitter, the rack containing the totalizer computer, the analog telemetering transmitter, and the digital telemetering transmitter.

At Brookfield gate station, the analog and digital telemetering equipment and the computer totalizer are housed in the Milwaukee Gas Light Company building. The balance of the instrumentation equipment, consisting of flow and static pressure transmitters, is housed in a steel enclosure adjacent to the pipeline company building.

At Milwaukee gate station, the instrument building, when completed, will house six flow transmitters, a static pressure transmitter, a temperature bulb and a computer totalizer.

Each instrument building also contains a gas detection alarm system that actuates a ventilating fan if the gas concentration in the building reaches one percent gas in air. The alarm system will cut off all power to the building if the gas concentration approaches two percent gas in air. Should a shutdown occur, a flashing red alarm light on the central dispatch board will alert the dispatcher.

Crews can then be directed to investigate the cause of the alarm. The light will not go out until the problem has been corrected.

Automatic Odorization Control

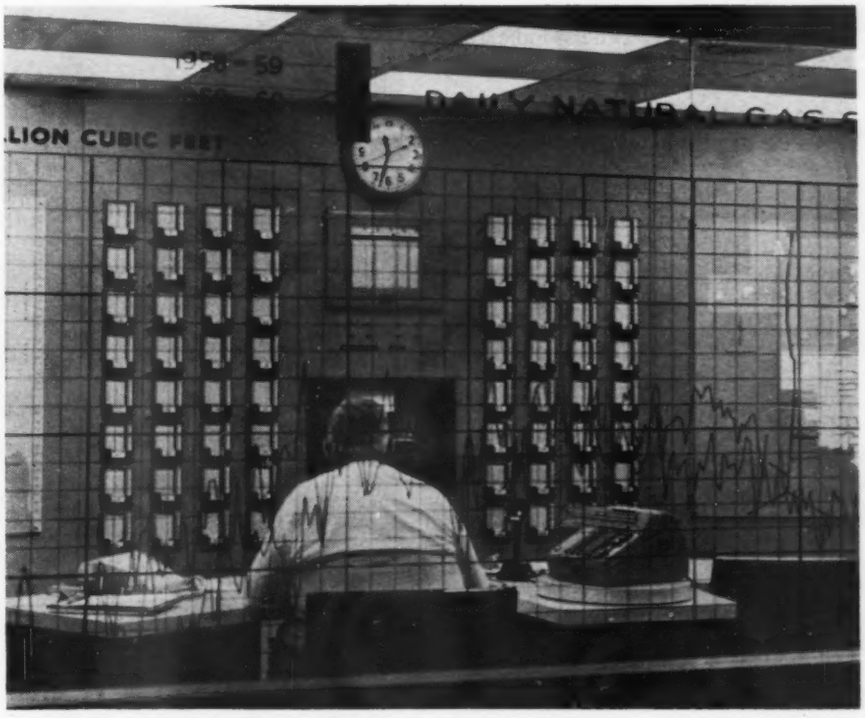
Another essential operation performed by the gate station computing equipment is automatic odorization control. A varying electrical signal from the computer totalizer accurately proportions the odorant to the amount of natural gas flowing through the station.

System Designed For Future

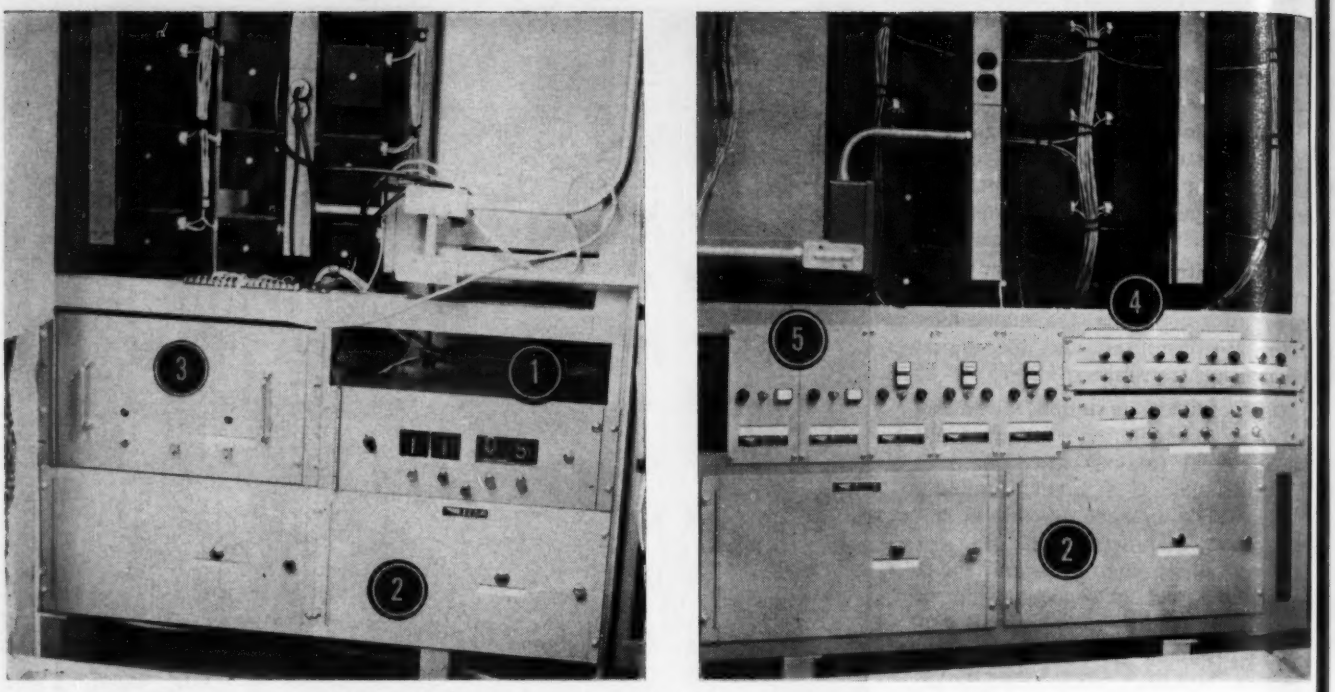
The entire instrumentation system has been designed to provide functional operation under today's conditions and still be adaptable to future expansion of the company's distribution network. When such expansion occurs, it is anticipated that an automatic dispatching technique, utilizing electronic computers for load programming and direct control of gas distribution, will be needed.

The dispatcher will then become a high-level monitor, most effective under emergency conditions, and not be directly involved in routine operational adjustments and decisions. The system is so designed that such a com-

Dispatch board contains 64 miniature strip-chart recorders (32 on each side); a multipoint receiver (top, center) capable of recording signals from 24 large-volume industrial interruptible customers' meters; a teletypewriter on which data printout is made; and bull's-eye lamps for the remote alarm system.



Dispatcher at work, as viewed through the glass wall. Visitors can observe dispatch operations without disturbing personnel. A tape recording describes the operation for visitors.



Rear view of dispatch panel. Equipment in the instrument racks include: 1) Digital clock; 2) Telemetering receivers; 3) Programmer; 4) Power supplies; 5) Alarm transmitter.

puter may be installed with minimum obsolescence in the present system.

New Dispatch Center

In accordance with gas dispatch's new role, the dispatch center has been relocated in the company's main office building to bring it closer to other departments with which it works closely. The dispatch board consists of four large panels. The two center panels contain 64 miniature strip-chart recorders, a multipoint receiver, a teletypewriter, and bull's-eye lights for the remote alarm system. All recorders, indicating lamps and system maps are face mounted.

An instrument rack in the rear center of the panel mounts the telemetering receivers and associated power supplies; the "fault finding alarm" transmitters, receivers and associated power supplies; the programmer and digital clock used in conjunction with the digital telemetering system; and the bridge power supplies for the recorders.

The teletype printer is located in the center of the dispatch board and is slide-mounted to facilitate changing of paper rolls. One digital telemeter transmitter, mounted in the rear instrument rack, supplies information to the printer. A time-interval switch, mounted near the dispatcher's control desk, permits selection of information printout on 5, 15, 30 or 60-minute cycles.

High and low pressure alarm lamps are located below the 24 point strip chart recorder. Three sets of 2 lamps, one high and one low pressure, are active. A fourth set is presently spare.

The outside panels display colorful graphic maps of Milwaukee Gas Light Company's service area and its gas transmission and distribution piping. These maps are installed on panels that eventually are expected to be needed to mount equipment necessitated by the system's growth.

A glass wall on one side of the dispatch office allows visitors to view the instruments on the board without disturbing the dispatcher. A tape recording has been mounted near the transparent wall so that visitors can hear about the entire operation by simply pushing a button.

To aid the dispatcher in load forecasting, Milwaukee Gas Light Company has contracted for weather forecasting service from the U. S. Government Weather Bureau and an independent meteorologist.

For the company's 270,000 customers, accurate load forecasting and improved gas supply control provide assurance of continued good service.

* * *

Former gas dispatch facilities were installed in 1949. Rapid growth of company's distribution system and impending introduction of a demand-commodity rate made these facilities inadequate.

THE ECONOMIC SIGNIFICANCE OF LNG LIQUEFIED NATURAL GAS

: Distribution Company's Viewpoint

Michael Anuskiewicz, *Assistant Chief Engineer, The Brooklyn Union Gas Company, Brooklyn, New York*

NO ONE WILL QUESTION THE FACT that the advent of natural gas revitalized the gas industry on the eastern seaboard during the past decade. It brought to a halt the costly postwar production plant expansion programs, materially increased capacity of distribution systems, and in some measure at least brought stability to the price of gas.

The over-all result was the availability of a premium fuel to our customers at a cost competitive with other fuels. The peak shaving requirement associated with the ever increasing acceptance of gas for domestic house heating became and will continue to be the major problem many of us are faced with today. This discussion covers the development of this problem, the possible place of a liquefied natural gas plant in the picture, and some of the problems such an installation would pose.

The effect of natural gas on The Brooklyn Union Gas Company provides a typical case history of the growth of the peak shaving problem.

Natural gas was first received in Brooklyn early in 1951 in the amount of 70,000,000 cu ft per day of firm contract and was used primarily for reforming and as enrichment in the production of a 537 Btu sendout gas. Upon assurance by our supplier that a second line entering the New York City area would be provided and that their system was adequately interconnected with other pipe lines, the company proceeded with conversion to natural gas sendout in 1952. Simultaneously, the water gas plants were converted to oil gas, so that, together with an existing LPG-air installation, we had a production capacity of 119,000,000 cu ft of high Btu gas. With our natural gas supply, we therefore had 189,000,000 cu ft available daily — a very comfortable position to be in going into the winter of 1952-53 — our first on natural gas — with the sendout for a zero day estimated at 146,000,000 cu ft. With only 14 per cent of our annual firm sendout attributed to house heating, it may be seen from our monthly load curve that we had no particular load factor problems.

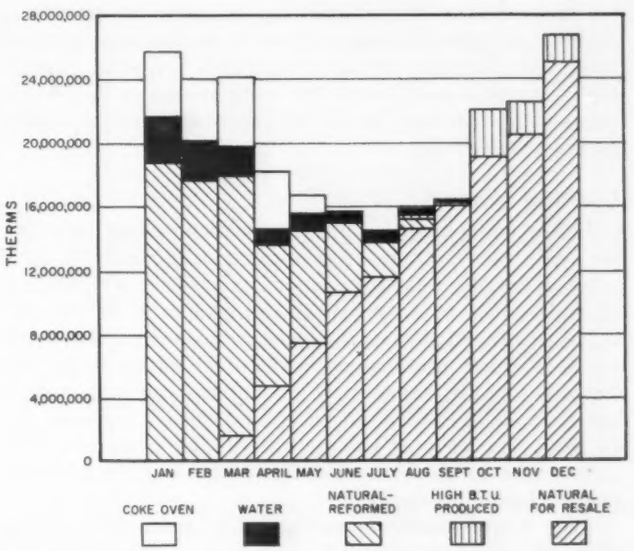


FIG. 1.

In the midst of conversion we filed the first of our rate decreases for space-heating, and at the same time instigated an aggressive sales campaign that we are still pursuing.

Results during the intervening years have been very satisfactory to all concerned — our customers, our stockholders, our employees, and, undoubtedly, to our suppliers.

Increased space heating sales increased our peaking problem. But with proper foresight a series of steps have been taken that have permitted us to more than hold our own. Chronologically, they may be listed as follows:

1. **In 1952** we signed our first interruptible customer — the Kent Avenue Power Plant of the New York Transit Authority.
2. **In early 1953** we filed an interruptible rate for other large volume service. This rate requires a minimum daily use of 750,000 cu ft, with the rate competitively adjusted to variations in the price of Bunker C oil.
3. **Later in 1953** we filed a revised off-peak rate to permit the acquisition of seasonal firm summer load.
4. **In autumn, 1954** we received delivery of our first storage gas from Transcontinental from the Oakford Storage Field.
5. **In 1955,** we started sales of interruptible gas to Consolidated Edison and Long Island Lighting Company for use in power generation.

What does LNG mean to the gas industry? Liquefied natural gas is available today and is being successfully utilized in Great Britain. Feasibility of large storage tanks has been proven in the U. S. There is no great mystery nor are there really unusual technical problems involved in designing and building the necessary plants. Biggest question is economic utilization . . . fitting LNG into the present scheme of domestic gas distribution operations. In this two-part article, adapted from presentations made by the authors at the 1960 *A.G.A. General Management Conference in Pittsburgh,* are details on how LNG can be utilized, the processes and equipment used, and data relating to costs.

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6. **In 1955** we acquired a new supplier — Tennessee Gas Transmission Company — providing additional firm gas and an equivalent daily amount of storage gas.

7. **In 1957** the Kings County Lighting Company and the New York and Richmond Gas Company were consolidated with Brooklyn Union. This provided direct access, through Staten Island, to a third supplier — Texas Eastern. Both firm and storage service are now also received from this source.

8. **In 1959** we contracted for additional storage from Transcontinental, this time from the Leidy Storage Field.

9. **Also in 1959** the Brooklyn Borough Gas Company was consolidated with Brooklyn Union, thus making the parent company the sole supplier for Brooklyn.

What has all of this done to our load factor? Figures 2 through 6 graphically show what has occurred. In Fig. 2 is shown saturation of one and two family gas house heating market. Fig. 3 shows firm gas sales by classes of customers for the period of 1953-1959. Fig. 4 shows our growth in number of space heating customers in the same period, while Fig. 5 compares natural gas supply and plant capacity with estimated maximum day sendout during the 7-year period. Fig. 6 relates sources and disposition of gas supply by months for 1959.

Looking Ahead

Before going into the future, let us then summarize where we stand today. To meet an estimated 380,000,000 cu ft sendout on a zero day this winter, we have had 432,000,000 cu ft available, consisting of 190,000,000 cu ft of firm natural gas, 115,000,000 cu ft of storage gas, and 127,000,000 cu ft of plant production. While daily plant production capacity initially was actually greater than our daily natural gas receipts, it is becoming a less significant segment year by year. Our 18 large volume interruptible customers have done much to fill in the summer valley, but we have run out of eligible prospects.

That is the picture as we face the future. *How do we meet the increasing demand?*

Over the next ten years we foresee an annual increase of 40,000,000 to 50,000,000 cu ft in our zero day requirement. In spite of probable increased off-peak sales, the daily summer increase increment will be relatively minor and, therefore, increased firm gas commitments should also be low. They would be more affected by the amount of gas that may have to be returned to some form of storage.

Weather Trends Affect Storage

When one starts talking about storage gas, a new factor must be taken into consideration. In the old manufactured gas days if production facilities were adequate to meet the maximum day, it did not matter too much how many such days there were during the winter, and the higher the degree days the more gas was made that year. But, with storage, there is a winter quantity to be considered as well as a daily quantity — and once that is gone there is no more.

Of course, if we had a normal or average winter each year, suitable and most economical means of meeting the load could be easily developed. But we are dealing with an element that reminds me of the University that advertised about a new summer short course in accounting — for women. Among the applications there was a short note written in a firm male hand which said simply, "Sir — there is no accounting for women!"

There is no accounting for weather. Many of us in the northeast design for a maximum sendout on a zero day — even though we only have one about every 10 years. Yet we get them — and must meet them. In the New York area we have a normal winter totalling 4750 degree-days, yet we must be able to meet a winter such as 1933-34 that had

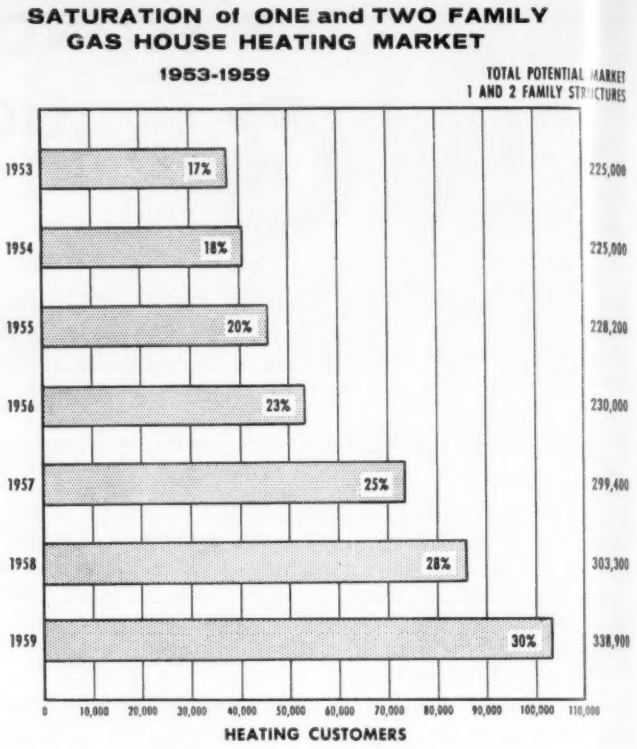

FIG. 2.

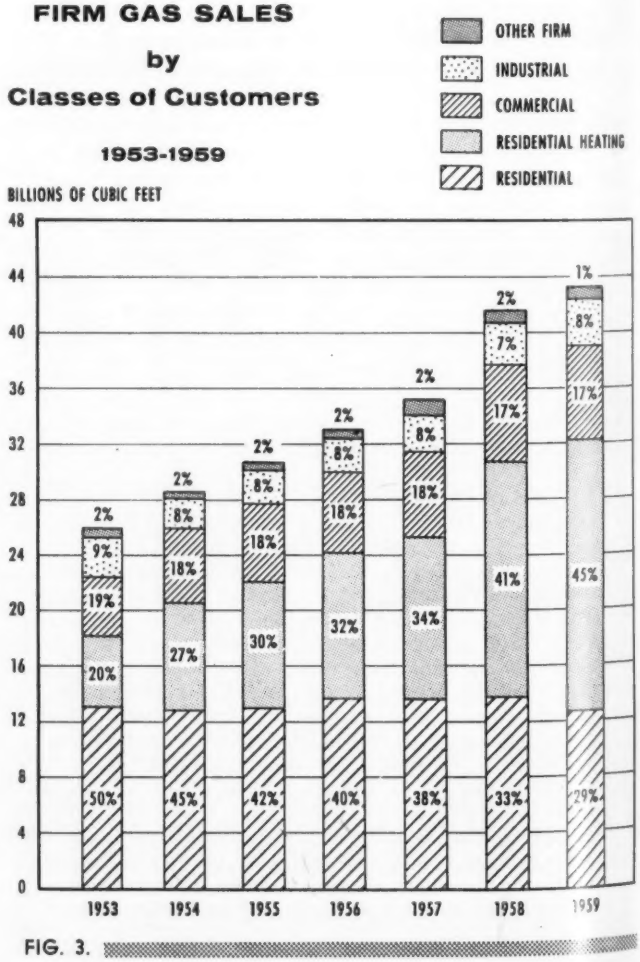

FIG. 3.

5817 degree-days. These happen even less frequently, yet we could get a winter such as in 1917, which was considerably more severe. Fig. 7 relates our degree-day trends for the period of 1899 to 1959.

To Use or Not To Use LNG

All of these facts are being taken into account in our study of the possible use of liquefied natural gas for peak shaving. We must have daily capacity that is very seldom used and, likewise, a seasonal capacity to meet our design winter. The economics, however, must be based on a normal winter. We also know that it will take a number of years to plan and build a plant — several more years to utilize it to capacity. We therefore are making a study of the winter of 1966-67 to examine the economics of our peak shaving problem.

The probable zero day sendout for 1966-67 is estimated to be 700,000,000 cu ft, contrasted to the 380,000,000 cu ft for this winter.

We have already made commitments for increased receipts of firm and storage gas over the next few years and contemplate other additions. We also plan on demolition this summer of the small production plant acquired in the Brooklyn Borough consolidation. As part of the study we have also considered the retirement of the older of our two remaining plants.

The net result after taking the above factors in account was a deficit in the daily requirement of 150,000,000 cu ft in 1966-67.

It has been assumed that storage gas with a winter quantity of 50 days of daily capacity will still be available, under the terms of our presently most favorable contract.

As a starting point, we have estimated the cost of a base liquefaction plant — having a liquefaction rate of 6,000,000 cu ft per day, storage of one-billion cu ft, and a regasification rate of 150,000,000 per day — at about $12,000,000. Land, connecting mains, and other facilities would result in a total cost of $16,000,000.

Initial Study Shows Promise

We have just completed the first set of data that has disclosed a number of interesting and, in some ways, disturbing facts. We have become aware of some of the ramifications of the problem, and realize that practical considerations may require compromising what has been calculated to be the most economic operation.

In this first run-through, we initially had to determine the sequence of oil-gas production in relation to use of liquefied natural gas storage. We have six Hall oil-gas sets, in which we normally use a reduced crude oil for gas making. There was no question that these sets should be used prior to the liquid storage. The balance of our equipment consists of so-called "bottom burner" oil-gas sets in which we normally use #2 fuel oil. Our first study indicated these sets should also be used before the liquid storage, as this reduced the liquefied gas storage requirements.

This, of course, is fine for a normal winter, but it was found that for a severe winter we would have adequate daily capacity, but in the course of the season would be required to make over 3-billion cu ft of oil-gas on the Hall oil-gas sets, and about 1¼-billion cu ft using #2 fuel oil. It is very questionable whether we could obtain the more than 40,000,000 gal of reduced crude oil that would be required. The probable solution would be the use of what would probably be a poor grade oil at a premium price or the use of #2 fuel oil. Thus it may be seen that it will be necessary to reanalyze our economics because of this situation.

It was also found that meeting of the full capacity deficit with contract underground storage gas would be extremely costly for a normal winter. Likewise, the use of liquefied

NUMBER OF SPACE HEATING CUSTOMERS

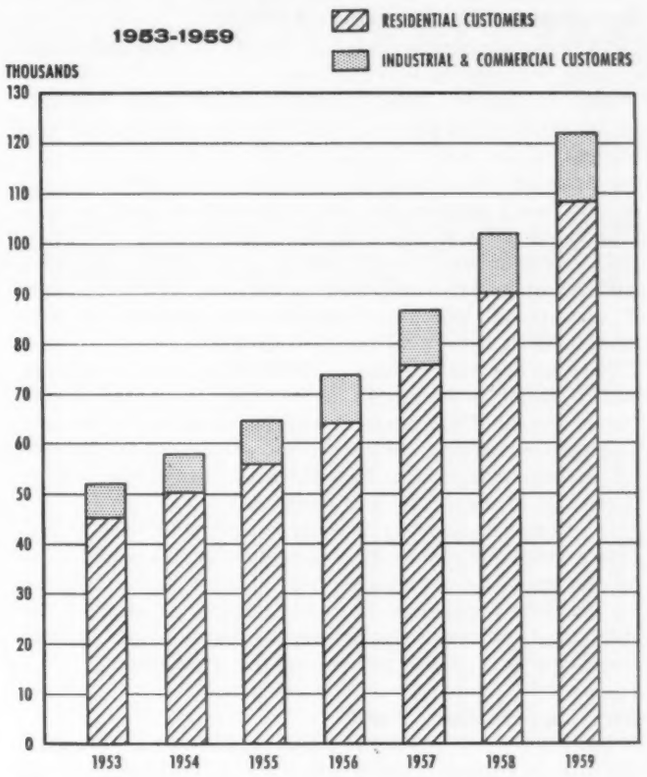

FIG. 4.

NATURAL GAS SUPPLY & PLANT CAPACITY vs. ESTIMATED MAXIMUM DAILY SENDOUT

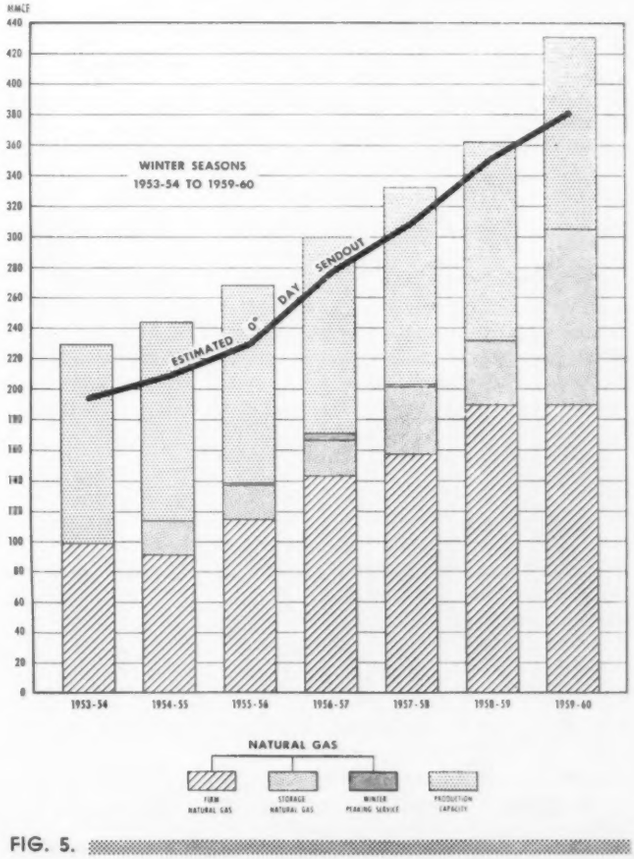

FIG. 5.

natural gas for the full volume increased storage tankage costs and thereby over-all cost.

Developing An Economic Balance

The next obvious step was to develop the most economic balance between the two methods.

This resulted in a plant having an initial liquefaction rate of 3,000,000 cu ft per day, 500,000,000 cu ft storage, and a regasification rate of 125,000,000 cu ft per day, to be supplemented with a daily deliverability of 25,000,000 cu ft of purchased storage gas. The total cost of such a plant (Fig. 8) is estimated at about $11,000,000.

This combination would result in an annual capacity cost, with no usage, of $2,671,610, compared with $4,180,000 if it were all purchased underground storage or with $2,850,000 if it were all liquefied storage.

Such an operation would confront the systems supervisor with a major problem. As an extreme, if we had a cold November or December, should he save his liquid and underground storage and make the maximum quantity of oil-gas and then perhaps be left with full stocks in storage if the rest of the winter was moderate?

It will be necessary to develop detailed schedules to provide a guide for day to day operations. It is our hope that by that time we can perhaps program some of the dispatching problems for solution by an electronic computer. We are still afraid, however, that it may be necessary to build in some kind of a crystal ball among the transistors.

Gas Liquefaction Plant

With respect to the liquefaction plant itself, we hope we will not disillusion anyone when we say that there is no great mystery nor are there any unusual technical problems in its design or operation. There are at least a half dozen firms ready to design and build such a plant on a turn-key basis. The refrigeration cycle used is dependent upon the size of plant and, as in all process plants, an economic balance must be developed between the extent of automation, manpower, and horsepower requirements.

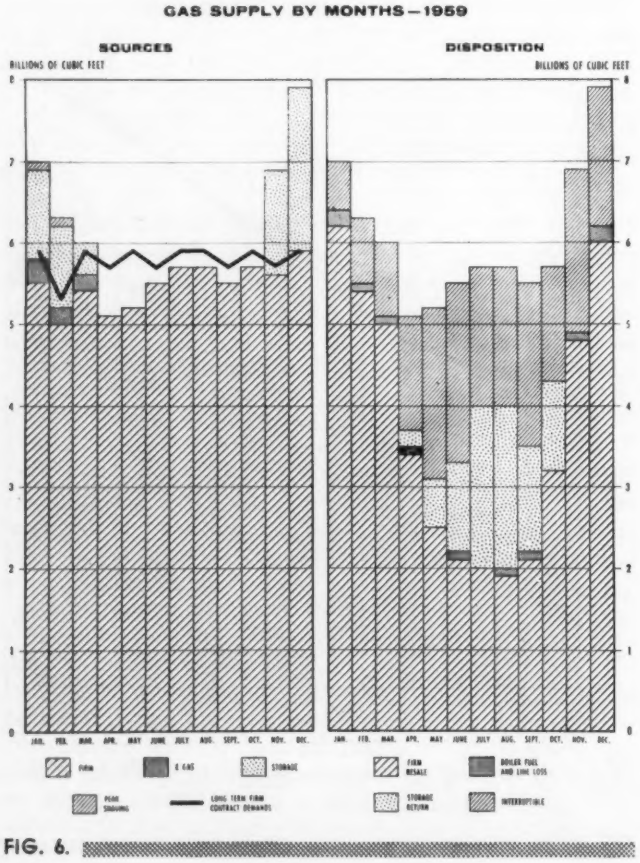

FIG. 6.

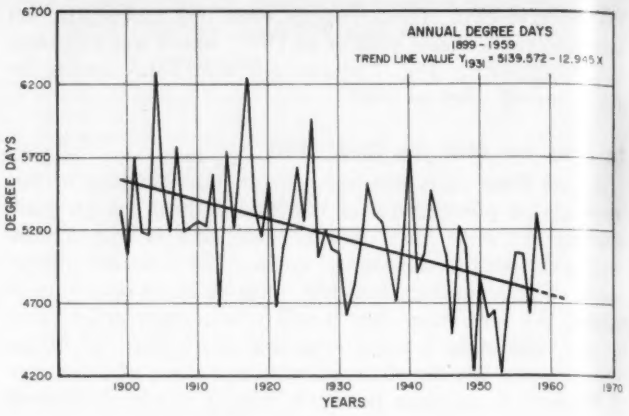

FIG. 7.

Tankage for liquid storage poses the greatest problem in view of the space requirements. With the tremendous advances in the field of cryogenics in recent years, tank design itself is no problem. Use of aluminum or stainless steel provides a safe vessel for the liquid at −260 F. Test work is also under way to determine whether a 9 per cent nickel steel would be equally suitable. This again is relatively simple design when one is aware of what is now being done in the storage and transport of liquid oxygen, nitrogen and even hydrogen.

We are talking of multiple tanks in a farm that must be adequately diked and protected. The plant and farm must be at a reasonable distance from residential or other occupied areas — but certainly the site does not require the isolation of a White Sands Proving Ground. Land for location of the plant will present a problem, because of the building situation in New York City, but one which we feel we can solve.

The final phase in the operation — vaporization of the liquid — is again a matter of heat exchange to return the liquid in the form of gas to our system.

Another advantage of liquefied gas storage exists in our case because all of our natural gas enters the western end of our territory. A storage plant at the other extreme or even midway would result in substantial reduction in further needs for high pressure transmission mains within our area.

Much Study Remains To Be Done

As you can see, we have done considerable work on this project. More remains to be done before a final decision is made as to how we will proceed. We must further explore the various ramifications that have developed thus far. We hope to complete our studies in the next few months.

We cannot ignore the fact that even though a liquefied gas plant gives us a limited number of days supply — only four in our first study — the annual cost per year of such capacity is under $15 per Mcf — compared to our existing purchased storage gas contracts which range from $28.87 to $48.63 per Mcf per year, assuming no use. We have a considerable amount of latitude to come up with a balance that should be practical and economical.

It will then not be too soon to start on the next phase — for, in looking forward to 1969-70, we estimate our zero day sendout will be up to 845,000,000 cu ft.

We will be very happy if some one finds an underground storage area closer to us than the present western Pennsylvania fields. Long transmission lines to a storage field used a relatively few days per year are not conducive to low peak shaving costs.

(Continued on Page 30)

THE ECONOMIC SIGNIFICANCE OF LNG LIQUEFIED NATURAL GAS

: The Supplier's Viewpoint

A. Russell Young, *Vice President, Constock-Pritchard Liquefaction Corporation, Kansas City, Missouri*

THIS PRESENTATION, primarily, summarizes our conclusions and brings up to date results of the past year's activities in the liquefaction and storage of natural gas. No fundamental changes in basic designs or economic thinking have occurred since presentation of a previous report on the *"Economics of Liquefied Natural Gas for Peak Shaving"* was made in May 1959, at the A.G.A. Production Conference in Rochester.

It must be noted, though, that **costs** included in that report were accurate at the dates prepared and have been reconfirmed in the past year, but future uses of such costs must always include an adjustment figure to accommodate the continuing rises in costs of materials, services, and labor. Such cost rises have been about 4 to 5 percent per year in the gas distribution industry.

Gas transmission investment costs will also increase in the future in line with other rising costs. Present investment costs for future gas pipeline systems transporting gas 1200 to 1400 miles to market currently require yearly fixed or demand charges of approximately $75 per Mcf.

In spite of these increased costs, there has been and still is a continued growing demand for natural gas as a fuel. All factors still indicate the gas distribution utilities, for the present, must keep increasing their firm gas from the transportation companies a minimum of 5 percent per year — in addition to developing other means of meeting greater increases of peak day demands.

There have been numerous inquiries as to the possible cost of obtaining liquefied natural gas by ship for meeting these future loads. Even as **base load gas,** all figures that we have assembled start at $.70 per Mcf and go up as the load factor decreases. The United States, with its economical interconnecting pipeline systems, is a good many years from having to import gas by ships from South America or other far off countries.

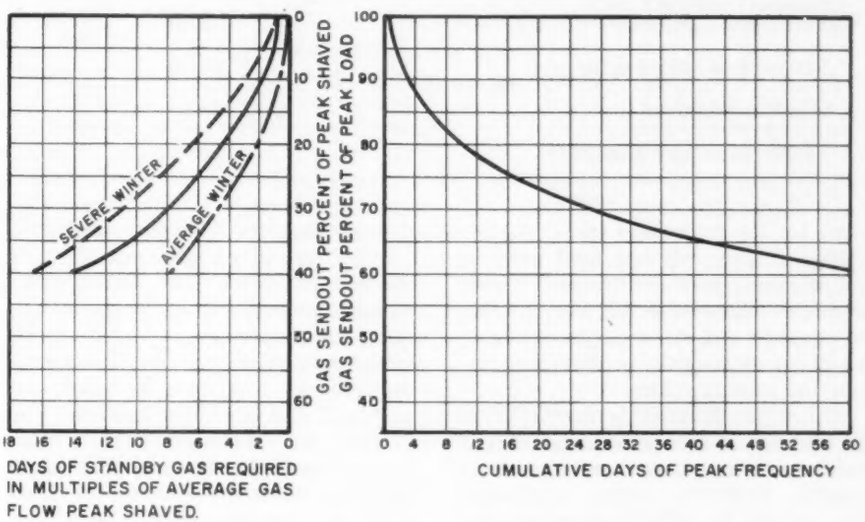
SEVERE WINTER
AVERAGE WINTER
GAS SENDOUT PERCENT OF PEAK SHAVED
GAS SENDOUT PERCENT OF PEAK LOAD
DAYS OF STANDBY GAS REQUIRED IN MULTIPLES OF AVERAGE GAS FLOW PEAK SHAVED.
CUMULATIVE DAYS OF PEAK FREQUENCY

FIG. 1. Gas sendout as percent of peak load (average of seven utilities).

For meeting "peak gas" loads, additional supplies will be needed in the very near future. However, we will undoubtedly first use our existing system to fuller advantage, including summer filling of underground storage; off-peak removal and storing of heavy hydrocarbons such as ethane, propane, and butane, and then use complete natural gas liquefaction for winter peak shaving.

Many gas distribution systems show approximately a 50 percent load factor. Quite often included in this average rate, however, are low revenue interruptible sales. Current oil surplus problems may mean future rate difficulties on these interrupted gas sales. A 30 percent load factor is a conservative and reasonable basis for the consideration of higher saturation incremental growth. With a 30 to 50 percent load factor, it is evident that considerable growth of firm gas sales can be obtained under existing gas supplies if the load can be averaged out by some form of peak shaving.

As storage is the major portion of the peak shaving plant investment, a study of average and severe winter system peaks and frequencies is necessary. Fig. 1 shows the gas sent out as percent of peak loads and volume requirements of such peaks.

The right hand curve shows cumulative days of peak daily rates exceeding any percentage of the peak. The left hand curves show the total yearly volume of gas required to shave any peak percentage expressed in days of standby in multiples of peak volume shaved. This is separated into average winter, severe winter (which is about double the average), and the solid line curve between the two as a rough medium for storage required. This is an average starting point for any gas distribution system load study, but each utility must review its own actual load and peak frequency experience.

As an example, if 35 percent of a system's peak demand is shaved, the total volume reading from the curve would be the 35 percent quantity times 6 days for the average winter and 12 to 13 days (times the 35 percent quan-

FIG. 2. ECONOMICS OF PEAK SHAVING WITH LIQUEFIED NATURAL GAS

	50,000,000 SCF/day (25-30% peak shaving) 2 MMSCF/day into 400 MMCF storage	250,000,000 SCF/day (35-40% peak shaving) 13 MMSCF/day into 2500 MMCF storage	500,000,000 SCF/day (35-40% peak shaving) 26 MMSCF/day into 5000 MMCF storage
INVESTMENT	$6,000,000	$27,500,000	$52,000,000
FIXED COST			
Charges of 15% for depreciation, interest, taxes, insurance, etc.	$ 900,000	$ 4,130,000	$ 7,800,000
Maintenance	30,000	110,000	205,000
Supervision	20,000	30,000	50,000
Fixed operating & tank refrigeration costs (minimum crew)	80,000	150,000	275,000
Total fixed costs/year	$1,030,000	$ 4,420,000	$ 8,330,000
Severe winter volume capacity, MMCF	475	3250	6500
Average winter volume required, MMCF	200	1500	3000
Total yearly gas peak shaved, MMCF (Assumed 1 severe in 5 years)	255	1800	3600
Gas liquefaction vaporization	70,400	295,000	466,000
* Total cost peak load gas service/year	$1,100,400	$ 4,715,000	$ 8,796,000
Equivalent demand cost	$22.00/M	$ 18.75/M	$ 17.60/M

* Commodity cost gas not included

tity) for the infrequent severe winter. Although probably not used once in 10 or more years, the "severe" winter conditions determine the total volume of stand-by gas that must be available to assure meeting the peak — thus setting the storage volume.

Oil or gas fields in the market areas that have been converted to gas storage field operations have been quite successful. Naturally, when available, they would be more economical and would be used before other forms of storage requiring construction of storage containers. Unfortunately, most of such storage fields are a long way from the distributing markets. Generally, such projects are major initial investments and as loads increase they probably will become 100 to 150 day "Winter Base" load gas instead of peak shaving, which we are thinking of in terms of 7 to 15-day peak gas supply.

The utilization of LPG, such as propane and butane, stored for vaporization and diluted with air to meet peak loads, should be a part of any distributing system's future design. Nearly all of the major utilities have some propane-air capacity, but the problems of interchangeability and gravity limits its use.

We believe the fluctuating price situation on propane and uncertainty of delivery, except on contract continuous use basis, is not going to improve from the gas utilities' standpoint. New propane markets are growing very rapidly in foreign and isolated areas, and current warm winter "apparent surplus" supplies of propane in the United States are misleading. Many gas utilities who have been favored with these dump surplus propane supply prices may find their average cost doubled shortly.

Fig. 2 presents a quick summary of the economics of peak shaving with liquefied natural gas. As we are substituting peak shaving gas for additional contract "demand" gas, we have summarized our total average yearly investment and operating costs for the average year into an EQUIVALENT "DEMAND COST." The larger plants reflect the most economy because of fixed costs and operating labor. This $18 to $22/M yearly "demand cost" compares with transmission pipeline demand rates of $50 to $75 per Mcf.

Current progress and development in gas liquefaction and storage have been carried on very rapidly in the past few years. The Constock International Methane, Ltd., a joint venture of the Continental Oil Company and the Union Stock Yard and Transit Company of Chicago, has recently obtained a new partner in Royal Dutch Shell. with the resulting change of name to *Conch International Methane, Ltd.*

Their plans go far beyond peak shaving and their research, design, and test operations are scaled to the large volume movement of liquid methane by ships. The barge mounted liquefaction unit operated by Constock since 1956 at Lake Charles, Louisiana, is obtaining valuable design and operating

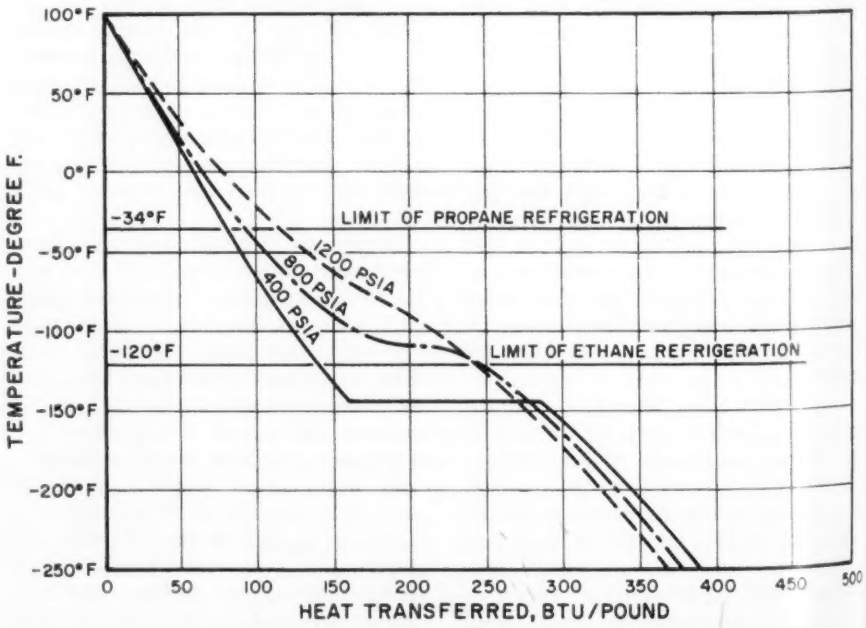

FIG. 3. Cooling curves for methane at several pressures.

FIG. 4. PROPERTIES OF LIQUID HYDROCARBONS

Compound	Molecular weight	Freezing point, F	Density, lb per gal @ 60 F	Density, lb per gal @ −260 F	Density ratio −260 F/60 F	SCF per gal @ −260 F	Gross heating value Btu/Scf	Gross heating value Btu/gal @ −260 F
CH_4	16.0	−296.5	2.5*	3.55	1.42	84.09	1,012	85,100
C_2H_6	30.1	−297.9	3.11	5.20	1.67	65.48	1,783	116,700
C_3H_8	44.1	−305.8	4.22	5.90	1.40	50.71	2,557	129,700
$I\text{-}C_4H_{10}$	58.1	−255.3	4.69	6.17	1.32	40.25	3,354	135,000
$N\text{-}C_4H_{10}$	58.1	−217.0	4.86	6.23	1.28	40.64	3,369	136,900
$I\text{-}C_5H_{12}$	72.1	−255.8	5.20	6.50	1.25	34.17	4,001	136,700
$N\text{-}C_5H_{12}$	72.1	−201.5	5.25	6.54	1.25	34.38	4,009	137,800
C_6H_{14}	86.2	−139.6	5.53	6.65	1.20	29.24	4,756	139,100

* Apparent density of dissolved methane.

data. This unit is supplying liquid methane for the "Methane Pioneer," a ship jointly owned by the British Gas Council and Constock International Methane Ltd., which is satisfactorily making regular deliveries of liquid methane to the British Gas Council's Canvey Island plant on the Thames River near London.

At both Constock's Lake Charles, Louisiana, terminal and the British Gas Council's Canvey Island plant, 100 MM scf of liquefied methane storage has been installed. These are flat bottom, dome roofed, double walled tanks operating at minus 259 F and atmospheric pressure. Inner tanks are aluminum and outer tanks are carbon steel. Including the Lake Charles tank, Chicago Bridge & Iron Company has built over 25 of this type tank since 1954.

The size of natural gas liquefaction and storage plants will affect investment costs more than either various processes for liquefaction or storage design. Increased inlet gas pressures help liquefaction as indicated by temperature-pressure relationship of natural gas (Fig. 3). The richness of gas into storage also has a large effect on plant costs due to increased Btu per gallon of richer gas, requiring less storage volume as shown by the low temperature properties of liquid hydrocarbons, (Fig. 4).

Schematic of a liquefied natural gas peak shaving plant, Fig. 5, shows the separate main component parts with corresponding average incremental investment costs:

1. General plant facilities, including office, warehouse, grading, fences, road, auxiliary and utility equipment common to all size plants, varying in cost from $1,000,000 to $2,000,000.

2. Gas liquefaction facilities varying as to gas inlet pressure and rate; average cost in 1960 for 140 psi, 1000 Btu natural gas is $260 per Mcf.

3. Vaporization — delivery facilities varying as to pressure and

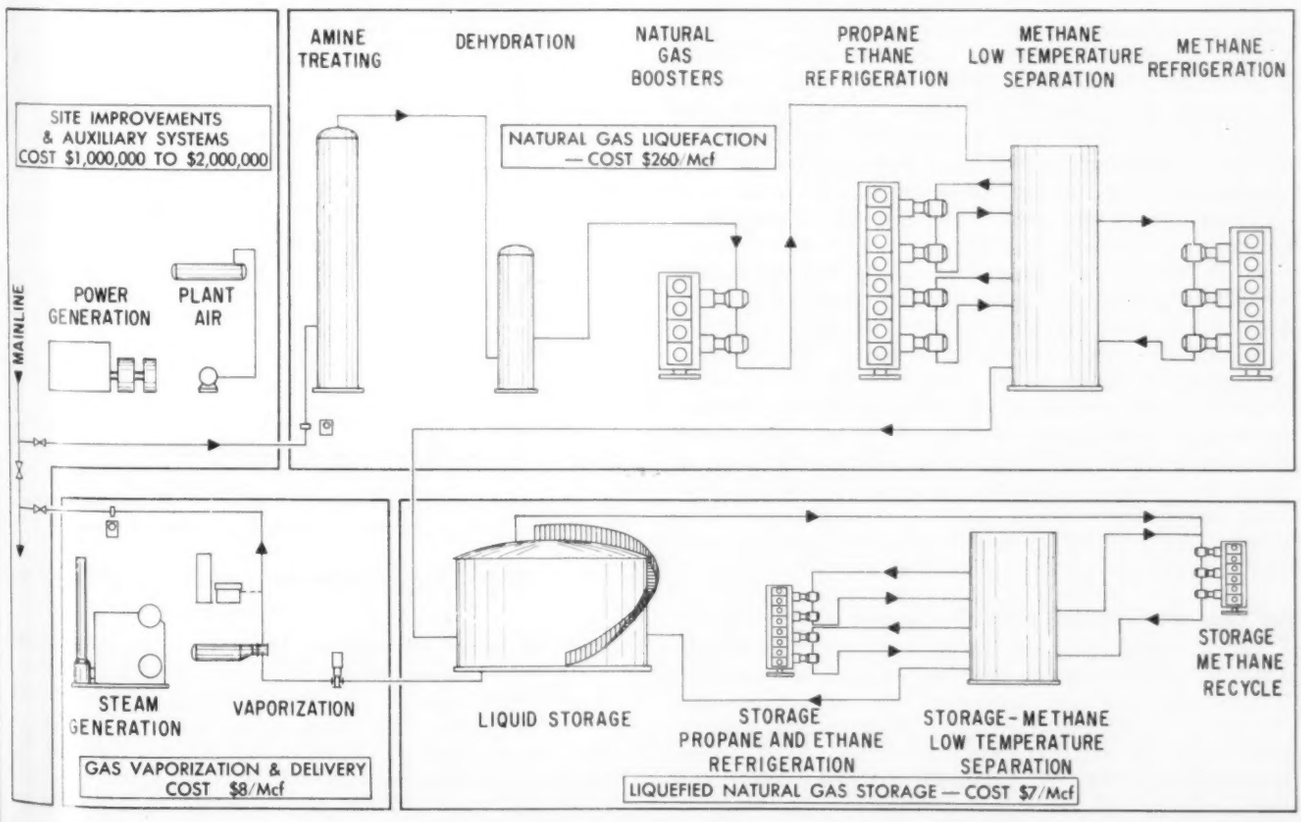

FIG. 5. Plant investment costs of liquefied natural gas peak shaving plants.

volume average in 1960 costs about $8 per Mcf.

4. Liquefied natural gas storage, based on multiple of 200,000,000 scf equivalent storage each, including necessary vent vapor recovery and re-liquefaction facilities (approximately 300-bhp refrigeration per tank) costs about $7 per Mcf.

Considerable time has been spent studying methods of possible reduction in these costs. General plant facilities may vary some, but primarily this plant location should be in a remote area with preferably 600 ft clearance around tankage. Sufficient facilities should be included to maintain tank refrigeration during storms or other interruptions.

Liquefaction facility costs will be less for higher pressure feed gas as the gas is liquefied at higher temperatures under higher pressures. Size of the plant has a large varying effect on gas liquefaction investment since the normal required rate is low due to usual 200 days available for summer filling.

Storage is the major investment item. Currently, various storage designs are being investigated and tested including use of 8% nickel-steel inner tanks; aluminum and nickel inner tanks buried in pre-stressed concrete outer tanks; aluminum and nickel steel tankage installed in rock caverns, and uncontained liquid methane stored in rock caverns.

Each of these will have to be evaluated in detail to determine their ultimate worth.

Of the above schemes, the presently used aluminum inner tank, enclosed in 3 ft of insulation with the carbon steel outer tank as supplied, erected, represents about $3.50 per Mcf or half of the $7.00 per Mcf total installed costs.

Most of the proposed schemes, such as uncontained storage in rock caverns, will show a reduction in the container cost, but will show an increase in other facilities required for a complete tankage installation which includes recompression and liquefaction of heat leak vapors, piping for injection and withdraw, etc. The most favorable of such possible storage schemes on average typical plants does not show a total plant investment saving of over 15 percent, and it is recommended that, for the present, costs be evaluated on proven design and equipment from costs as shown in Fig. 5.

It should be emphasized that liquefied natural gas storage is not for the small distributing utility because a minimum size plant will cost in the $3,000,000 range. Sufficient size site or remote area is necessary regardless of the type of storage used.

Materials, equipment and designs must be selected from the standpoint of good conservative engineering standards and not because they are cheaper. Even with this necessary conservative approach to the problem, natural gas liquefaction and storage offers an economical means of meeting these costly short peaks, permitting substantial revenue growth under existing gas supplies.

* * *

(Continued from Page 26)

Some years ago we made an investigation into the possibility of finding suitable formations on Long Island for aquifer storage. The results did not appear sufficiently promising to continue with the work.

It would then appear that, aside from additional increments of pipeline gas, additional liquefied storage plant will still be very much in the picture. I am sure we will also have to take into consideration use of additional LPG for the top step of our maximum sendout, for by that time we will be able to use a relatively substantial amount without materially affecting the interchangeability of the gas and, consequently, our customer relationships. This could very well lead us to consideration of cavern storage of propane or butane for this purpose.

In the field of transport of liquefied natural gas, the gas industry is familiar with what has been done and is being done by the British Gas Council and Constock in the transport of liquefied natural gas to Great Britain. The feasibility of large storage tanks has been proven in the Lake Charles installation and on Canvey Island in the Thames Estuary. We presently have adequate valley gas to meet our immediate requirements for storage. It would certainly be to our advantage, however, to have our facilities adjacent to water borne transportation. If at some future date we can purchase liquefied domestic or foreign gas at a lower cost we must be willing to listen to and act upon such an offer.

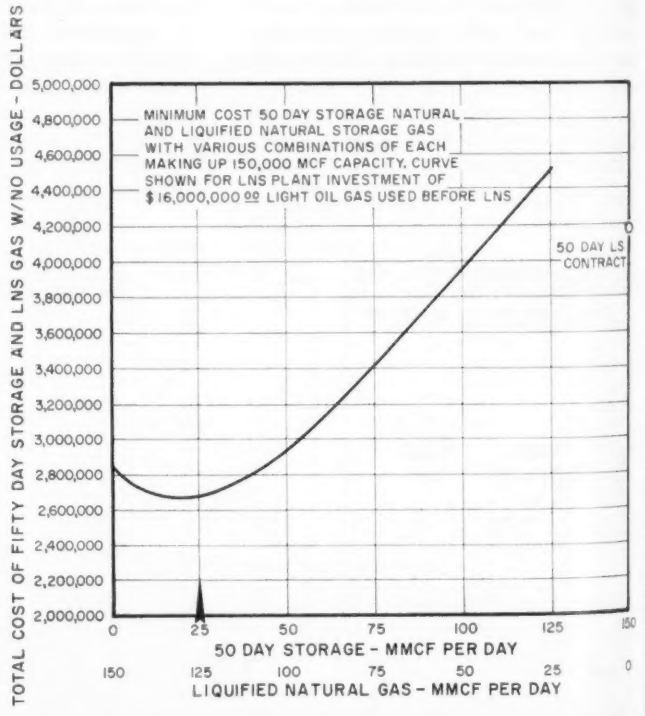
TOTAL COST OF FIFTY DAY STORAGE AND LNS GAS W/NO USAGE - DOLLARS
5,000,000
4,800,000
4,600,000
4,400,000
4,200,000
4,000,000
3,800,000
3,600,000
3,400,000
3,200,000
3,000,000
2,800,000
2,600,000
2,400,000
2,200,000
2,000,000
MINIMUM COST 50 DAY STORAGE NATURAL AND LIQUIFIED NATURAL STORAGE GAS WITH VARIOUS COMBINATIONS OF EACH MAKING UP 150,000 MCF CAPACITY. CURVE SHOWN FOR LNS PLANT INVESTMENT OF $16,000,000.00 LIGHT OIL GAS USED BEFORE LNS
50 DAY LS CONTRACT
0 25 50 75 100 125 150
50 DAY STORAGE - MMCF PER DAY
150 125 100 75 50 25 0
LIQUIFIED NATURAL GAS - MMCF PER DAY

FIG. 8.

An Era of Change and Challenge

This is a challenging era. For us it has been such a short step from gas produced by sweat and toil and heats to 1500 F with noise and busy confusion — to the present compressor stations with polished floors, sound proofed city gate stations that are operated from miles away, and gas stored as a liquid at −260 F in aluminum or stainless steel tanks with overcoats.

Today, huge amounts of money are riding on the decisions for future gas supplies. There has never been a time when more careful analysis and correct and precise information were required. It is definitely a period during which it will be necessary to "think of the moon" so to speak — but with feet well grounded in the financial realities. The challenge of the potential load is there. If we can keep our minds open and our pencils sharp, we will meet the challenge.

* * *

AQUIFERS for Underground Natural Gas Storage

2 | Criteria for selection; geology, lithology, economics

Joseph A. Kornfeld, *Natural Gas Consultant, Tulsa, Oklahoma*

ENGINEERING, GEOLOGIC AND ECONOMICS FACTORS EMPLOYED FOR SELECTION OF AQUIFERS for underground natural gas storage service are discussed in this second installment. These basic factors are the criteria for the determination of feasibility of conversion of underground folder aquifers and are arranged as follows:

A. Strategic location.
B. Economics feasibility.
C. Aquifer characteristics.
D. Reservoir performance characteristics.

Strategic Location

Importance of aquifer storage to the gas distribution industry is related to the wide occurrence of aquifers in most of the drainage basins of the nation. (See Fig. 1, *Principal Drainage Basins of the United States.*)

These aquifers, where found under structural and geological conditions of adequate closed anticlines or domes, can serve as a reservoir site for an underground natural-gas storage reservoir, into which gas can be **pumped** during seasons of low market demand and **withdrawn** during seasons of peak-day and high market demand. Thus these natural, buried water-filled folds have served the gas utilities near major metropolitan areas, since many of these great population concentrations are not situated near depleted oil and/or gas fields that might be converted to underground storage service.

The striking observation drawn from these economically-practical, geologically-sound, industry-proven aquifers that have been placed in service near major metropolitan areas such as Chicago, St. Louis, and Des Moines, is that gas storage departments of *these same gas distribution companies and/or their suppliers are already searching for additional major reservoir sites situated adjacent to their pioneer projects.*

For example, Natural Gas Storage Company of Illinois, a subsidiary of Peoples Gas Light and Coke Company, the major gas distribution company in the Chicagoland area, and operator of the vast, successful Herscher Dome storage project, is studying an aquifer prospect near Mahomet, lying between its present Cooks Mill and Herscher facilities.

Another aquifer reservoir site in the Chicago area is being studied by Northern Illinois Gas Company northeast of its Troy Grove, Illinois pilot project between Mendota and LaSalle, Illinois, which has been in operation since July 23, 1958.

In the vicinity of its pioneer aquifer project at Florissant, only 16 miles north of the center of greater St. Louis, geologists of the Laclede Gas Company are surveying another aquifer reservoir site in the St. Peter sandstone formation. Again in the same metropolitan area, Mississippi River Fuel Corporation is surveying a possible aquifer site south of St. Louis.

Thus, these examples demonstrate that the principal factor in selection of an aquifer reservoir site takes into consideration:

1. Proximity to major metropolitan cities of **concentrated domestic demand;**
2. Proximity to main-line terminals serving these areas

EDITOR'S NOTE: This installment is the second in a series of four engineering articles on "Underground Natural Gas Storage in Aquifers" that is being presented each month as part of AGJ's continuing educational-refresher series on natural gas and gas distribution operations.

The first installment, which appeared in the April 1960 issue, analyzed the need for gas storage, types of storage, and history of aquifers. This installment covers criteria for selection of aquifers, geology, lithology, and economics. Remaining installments will cover facets of aquifer storage as follows

3: Drilling, logging and completion of input, output, and service facility wells.
4: Performance data of aquifer-type natural gas storage reservoirs; use of tracers in remedial operations.

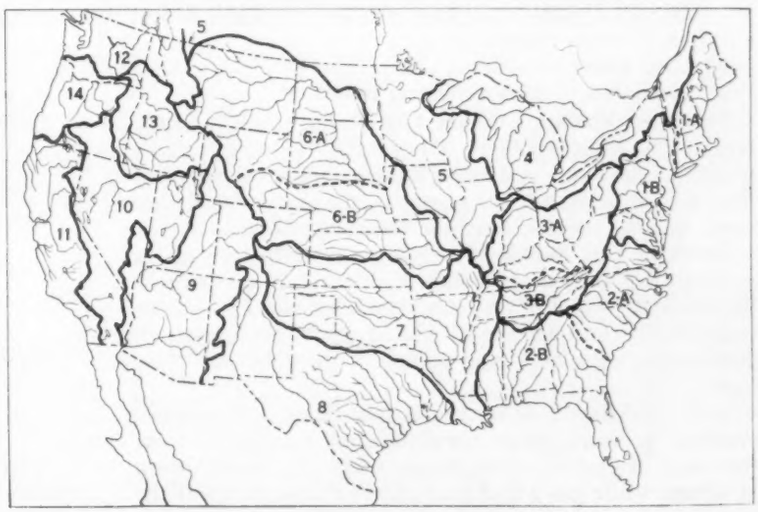

FIG. 1. Principal drainage basins of the United States are delineated by the heavy boundary lines. Each natural area shown is covered by the 18 annual volumes on surface-water supply published by the U.S. Geological Survey on ground water and aquifiers. *(Map Courtesy U.S.G.S.)*

of large-magnitude gas markets in areas of high population densities; and

3. The rate of population growth which will influence the future of that gas market and other economic factors which will influence the **permanence** of that gas market, such as **availability** and **price** of competitive fuels.

Economics Feasibility

Second principal factor relating to feasibility of aquifers for underground natural-gas storage service is economic feasibility. This factor may be subdivided into:

1. Overall investment cost.
2. Performance characteristics of the aquifer.
3. Volumetric size of the aquifer.
4. Depth factor, and
5. Ratio of annual storage movement volume to the volume of cushion gas.

Overall investment cost. This item may be related to

a. Cost per Mcf of gas delivered throughout the heating season
b. Cost per Mcf of storage gas delivered for peak-day withdrawal service, and
c. Cost per Mcf per horsepower of installed compressor capacity.

Performance characteristics. Hydrology of the aquifer as measured by permeability and specific yield determines the response of the aquifer to injection and withdrawal movement. The feasibility of the aquifer for underground natural-gas storage service can be evaluated from the pressure-volume curve as determined from actual experience over successive years of injection and withdrawal.

Volumetric size. Reservoir volume of the aquifer must be of sufficient size to warrant the capital expenditures required for installation of required facility wells, dehydration units, compressors, and pipelines required for injection-withdrawal operations.

Shallow depth. The economic factor of depth is important in estimates of investment costs of drilling input, output and observation or pressure-measurement wells.

This cost assumes major importance where the aquifer structure extends over a vast surface area of low-structural relief which would require the drilling of a large number of facility wells.

Well spacing of facility wells is involved in the estimation of investment costs. Close spacing may be considered under conditions of

a. excellent reservoir performance of the aquifer, i.e., reservoir media conditions of high permeability and high specific yield;
b. large reservoir volume, and
c. conditions of **high structural relief.**

Turnover Volume/Cushion Gas Ratio. An economic objective is to obtain a high ratio of turnover storage volume to the volume of the cushion or permanent gas volume. This item is again related to the geometry, the vertical structural relief, and the effective reservoir volume of the aquifer.

Artificial Gas Bubble. The reservoir mechanism of an underground natural-gas storage aquifer, in an over-simplified analogy, is that of an artificial gas bubble. This bubble is created by introduction of natural gas through injection wells drilled into the crestal portion of the anticlinal structure.

Gas, introduced at pressures exceeding the original reservoir pressure, forces the interstitial water away from the sand grains. Injection forces interstitial water **down structure,** while gas withdrawal allows displacement of the gas through movement of the water **up structure,** or toward the higher contours of the buried fold. Thus this gas bubble expands or contracts as gas is injected or withdrawn.

Existence of a system of rock fractures in the aquifer

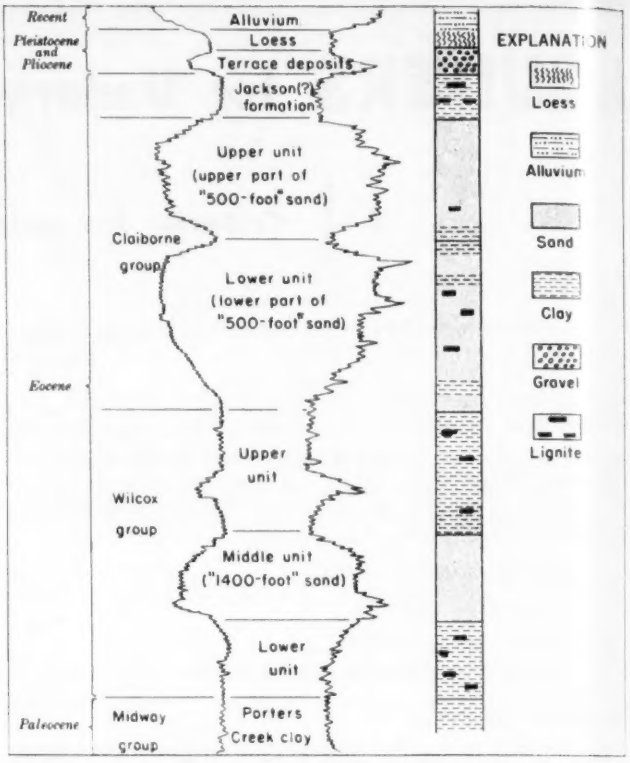

FIG. 2. Generalized electric and lithological logs of aquifers in the Memphis area of the Mississippi River valley, illustrating certain aquifers in the Eocene rocks of the Gulf Embayment.
(Courtesy U.S.G.S.)

itself, which permits undue migration of the contained gases and fluids into thiefing zones, will affect reservoir performance. If this migration is of sufficient magnitude, remedial action will be required, well workovers, use of tracers, and well logging, to correct the condition.

Basically, it is the character of the reservoir rock which determines the ease and efficiency under which this reservoir mechanism will operate when placed in actual service. Performance is analyzed by plotting on rectangular co-ordinate graph paper, metered volumes vs. reservoir pressures, for both **the injection period** during the summer season of low market demand, as well as **the withdrawal** period during the winter season of high market demand.

Aquifer Characteristics

Lithology. Pettijohn has divided the lithological characteristics of sediment properties into (a) scalar properties and (b) vector properties as follows:

SCALAR PROPERTIES

a. Size and sorting.
b. Shape and roundness.
c. Composition.
   Gross: percent sand, shale, limestone.
   Constituents: mineral frequencies, pebble counts, etc.
d. Thickness
   Total
   Average of individual beds.

VECTOR PROPERTIES

a. Planar: i.e. cross-bedding.
b. Linear: primary sand lineation, fabric (long-axis lineation, etc.).

The search for an aquifer reservoir rock is a study of ground-water supplies. These reservoirs may range through porous sandstones, dolomites, limestones, in varying proportions of compositions. The geologic age is not restricted as to time, and adequate aquifers have been converted to underground natural-gas storage service ranging from basal

Paleozoic through the Mesozoic and into the Quarternary systems.

GEOLOGIC AGE OF AQUIFERS

Paleozoic system. Lower Paleozoic sandstones and dolomites of Cambro-Ordovician age contain the aquifers employed in development of the Herscher and Troy Grove projects near Chicago in northern Illinois, at Redfield, Iowa, and at Florissant, north of St. Louis.

M. E. Wilson states that the St. Peter and Roubidoux sandstones are known as valuable aquifers in the Mississippi River valley. The Roubidoux supplies the deep well water in the Joplin district and Springfield, Missouri.

The "Corniferous" limestone of Siluro-Devonian age is the aquifer utilized in the Doe Run storage field in Meade County, Kentucky, by the Louisville Gas & Electric Company. The "Corniferous" is a "catch-all" for a number of different Silurian and Evonian limestones underlying the Ohio shale in Kentucky. At the outcrop in Kentucky, the overlap is by the Jeffersonville limestone in the west and the Boyle limestone in the east and southwest, according to McFarlan, Freeman, and Nelson.

Mesozoic system. The principal aquifer objective for potential reservoir sites in the Northern Great Plains region of the United States is the Dakota sandstone of Upper Cretaceous age. The Dakota underlies a vast region and is an important source of ground water throughout North Dakota, South Dakota, Montana, Wyoming, Nebraska, Kansas, Colorado, and Utah.

The Tuscaloosa group of Lower Cretaceous age is an important aquifer in central Mississippi and western Alabama. At the outcrop, the Tuscaloosa group rests with great unconformity on pre-Mesozoic rocks along the southern extension of the Appalachian Mountains, in these two states.

Tertiary system. One of the most important aquifers found throughout the Gulf embayment extending throughout the Lower Mississippi valley is the Eocene Wilcox sandstone series. A typical columnar section of Eocene Wilcox sandstone is shown in Fig. 2.

GROUND WATER

United States Geological survey hydrologists define "ground water" as that water occurring below the surface of the ground, which is in the zone of saturation and which is, therefore, available to wells and springs.

In many areas, most of the ground water is derived from precipitation that falls on the outcrop area or on adjacent areas. Most of the water that falls evaporates, is used by vegetation, or is carried away as surface runoff. A small fraction of this water, however, enters the ground and eventually joins the body of ground water.

Ground water moves from the areas of recharge toward areas of natural or artificial discharge. The rate of movement depends in part upon the hydraulic gradient represented by the slope of the water table or of the piezometric (pressure-head-indicating) surface.

Meinzer defines the water table as the upper surface of the zone of saturation except where that surface is formed by an impermeable body, in which case the water table is absent and artesian conditions exist.

Under artesian conditions, water is confined within the water-bearing formation by relatively impermeable beds and will rise, in a well that has been drilled through the confining layer, to a level above the water-bearing formation that depends on the pressure head.

The piezometric surface is the imaginary surface that represents the height to which the water will rise in wells tapping an artesian aquifer. The water table or the piezometric surface is not a plane surface but **a sloping one** that

ELIMINATE COSTLY LUBRICATED PLUG VALVES

REPLACE THEM WITH...

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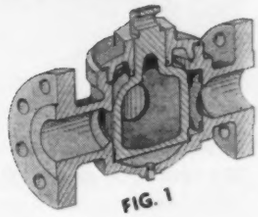

FIG. 1

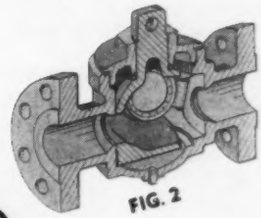

FIG. 2

The PLUGAROO combination Plug and Check Valve eliminates expensive lubricating equipment . . . reduces costly maintenance trips. Fig. 1—A quarter turn closes the plug against clapper for positive seal, yet wide tolerances prevent plug or valve-body gauling. Fig. 2—In "open" position, the 20° vertically hinged clapper seals under its own weight and the PLUGAROO operates as a Synthetic Seal Check Valve. Plug locking device is optional on your request. The PLUGAROO is available in semi-steel, steel, and aluminum-bronze thru series 90 (2160# W.P.—3250# Test). API, ASA dimensions for all standard end connections. For details, write:

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may have irregularities. This surface is not stationary, but fluctuates in response to

a. additions to water in storage,
b. withdrawals from water in storage, and
c. changes in barometric pressure.

Configuration of the water table or piezometric surface is portrayed by means of contour lines which are similar to those employed to illustrate the geomorphology, or the shape of the land surface as expressed on topographic maps. The direction of movement of ground water is at right angles to the contour lines.

Aquifers are recharged principally by precipitation in areas where they crop out. Auxiliary contributory factors to recharge are by percolation or migration (leakage) from subjacent porous media.

Significant hydrologic properties. Wenzel states that the two hydrologic properties of greatest significance in water-bearing formations are *permeability* and *specific yield*.

The *specific yield* of a water-bearing formation is defined by Meinzer as the ratio of (1) the volume of water, which after being saturated, it will yield by gravity to (2) its own volume.

It is a measure of the quantity of water that a formation will yield when it is drained by lowering of the water table. Thus, if 100 cu ft of saturated water-bearing material, when drained, will supply 20 cu ft of water, the specific yield of the material is said to be 20 percent.

STRUCTURE

The principal structure of aquifers favorable for underground natural-gas storage service is the anticline or dome. The condition is necessary in order to contain effectively the artificial gas bubble that will be formed by injection of natural gas into the crest or closure of the structure.

An important geologic factor is the magnitude of structural relief. The structure shape can be domal, but the proportions of the major axis to the minor axis are not critical. These proportions, however, may influence the character of the development of the fields, well spacing, number and arrangement of observation or pressure-measurement wells, and the like.

A broad, low-relief anticline or dome is preferable to a small, high vertical relief dome.

Good sealing characteristics of the aquifer are very important in the determination of the adequacy of the aquifer for underground natural-gas storage service. The natural occurrence of impervious shales above and below the aquifer is an advantage in obtaining protection of the aquifer from migration of contained gas.

GEOPHYSICAL TECHNIQUES

Geophysical methods employed in determination of the location and dimensions of an anticline for underground natural-gas storage service include areal geology, aerial photography, core-drilling and seismic refraction techniques.

Herscher dome. One of the major geophysical programs undertaken in aquifer exploration history was made in connection with the exploration of the Herscher dome, near Chicago, Illinois. Herscher is an elongate, asymmetrical anticline with an areal extent of more than 8000 surface acres and a vertical structural relief of more than 200 ft.

The existence, size, and shape of the Herscher geologic structure was determined through the drilling of more than 100 core holes to a shallow "marker bed," which was known to be structurally shallower and which reflected the deeper reservoir beds in which the gas is stored.

In confirmation of the structural configuration of the shallow "marker bed," geophysical methods were employed. These comprised running of 100 seismic refraction lines across the Herscher dome.

Initial drilling exploration comprised three exploratory test wells drilled to a depth of slightly more than 2000 ft into the Cambro-Ordovician beds. These bore holes revealed the composition of the reservoir bed, the strata lying above and below it, and were analyzed from cores recovered from these wells.

Bottom-hole pressure bomb traverses conducted in these deep well bores revealed significant static pressure differentials prevailing in each of the objective aquifer areas and indicated the extent of sealing between aquifer strata.

Florissant dome. The exploration techniques employed in mapping the Florissant structure north of St. Louis, Missouri commenced with shallow well drilling originally mapped by surface geology methods by the Missouri Geological Survey. St. Louis lies in a marked syncline of large size in which small anticlines exhibiting a north-northwest trend cut the regional dip transversely, notes M. E. Wilson.

Following the shallow-well drilling program covering 25,000 acres, which proved the existence and outlines of the Florissant dome, deep well evaluation was conducted to penetrate the entire sedimentary sequence comprising 3240 ft of sediments down to basement rock of pre-Cambrian age. The aquifer, however, was found at a depth of only 1450 ft in the St. Peter sandstone where a 100-ft thick body of sandstone with high permeability values, was encountered.

Additional tests were conducted to determine the sealing characteristics of the cap rock overlying the St. Peter sandstone aquifer. Hydrostatic tests which were conducted on cap rock core samples proved the impervious character of the rock. Reservoir pressures measured in water wells drilled to cap rock, and in wells drilled into the St. Peter aquifer sandstone, proved the existence of a significant pressure differential which suggested the lack of communication between the two strata.

(A selected bibliography will appear at the end of the last installment in this series.)

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Test Yourself On Sales Law

Law makes the difference between a live contract and a dead deal . . . knowing the elements of sales law will help keep you out of trouble

G. T. Medlock, *Attorney-at-Law,*
and
R. D. Stevens, *Management Consultant, Washington, D.C.*

MAKING, OR PERHAPS, BREAKING A CONTRACT IS NOT NEW. Almost every firm engaged in distribution and utilization of natural gas, and those gas utility companies merchandising appliances are regularly faced with the task. Thus, contract law governs everyday operations to quite a degree.

It is not essential that you be a legal expert, but you should familiarize yourself with some basic points on this subject. Legal mistakes on your part in your business dealings with others can prove costly.

During the course of a year, your company probably enters into hundreds of contracts, oral, implied, or written. Under such contracts, you have created legal rights. At the same time, you also may incur legal liabilities without realizing it. You may be at a disadvantage if you do not know or understand your legal rights and obligations as given and imposed by contract law.

Position of the courts. You realize, of course, that you are **not** compelled by law to enter into any particular business contract for your company. When you do enter into such a contract, the rights and duties which you have under the contract are derived from your *voluntary agreement*.

It is true, however, that the court will not **make** a contract for you. If you and another party enter into a legally enforceable contract, obviously, then, the court will interpret and enforce it as such.

You can see, therefore, that a working knowledge of contract law can be of the highest practical value in handling your company's business transactions and you should know all you can about it.

Classification of contracts. There are, of course, various types of contracts. These may be classified as follows:

1. The *contract-under-seal* is the common example of a formal contract. It was the first type of contract to be recognized and enforced by the court. It had to be written, signed, and sealed. Today, however, in a number of states the necessity of the seal has been abolished.

2. An *executed contract* is one in which all parties thereto have performed their legal obligation which they assumed under it. But until all the obligations have been filled, the contract is *executory*.

3. An *express contract* is one in which the terms have been conveyed in words, oral or written, which can be proved to have been expressed. The words show the obligations of the parties involved. In an implied contract, however, the obligations of the parties are inferred.

4. A *void contract* is one that has no legal effect — one the court will not enforce.

5. A *voidable contract* meets the requirements or essentials of a contract but, for some reason, may not be enforced by the court.

What makes a contract?

There is no doubt that a contract may be defined as an agreement between two or more persons to do or not to do a specific thing, and in which the minds of the parties involved meet and concur in understanding the terms.

In plain, everyday language, a contract is a promise or set of promises for the breach of which the law gives a remedy, or the performance of which the law in some way recognizes as a duty.

You will find it interesting to learn that a legal, enforceable business contract consists of the following elements:

1. **You and the other party must have had a legal capacity to contract.**
2. **There must be an offer and an acceptance.**
3. **There must be reality of consent.**
4. **Sufficient consideration must be given; and**
5. **The contract must be in proper form and have legal objects.**

It is clear, therefore, that a contract arises out of a voluntary agreement between you and the other party. The obligations imposed by the contract are self-imposed — meaning that the parties freely entered into it.

Contrary to popular belief, the contract of a minor — one under age — is

not void, but voidable at the election of the minor. The contract of a person who is declared judicially insane is void; and, the law of some states places certain limits upon a married woman's capacity to contract.

Here's how you define an offer: A statement of what the offeror is willing to do, and a statement of what the offeree will do in return.

Your offer must be made with a contractural intent — meaning that, as the offeror, you must have a serious intent to be bound by the terms of your offer if accepted.

In addition, terms of the offer must be reasonably clear, and to be effective, it must be communicated to your offeree. In accepting the terms of your offer, however, your offeree agrees to them with full intent to be bound.

What is an agreement?

You should know that every contract is an agreement, but that not every agreement is a contract. You probably make agreements for your company daily that are not enforceable by law because you have no intention to enter into a binding contract.

For illustration, an agreement to attend a convention of executives in the gas distribution industry with someone is an agreement, but it is not a contract. Your agreement does not create a legal obligation. It creates only a social obligation. The reason why your agreement does not contain legal obligation — and hence, a contract — is that it does not contain what is known as *consideration*.

You probably think that consideration means giving or paying money, but this isn't always true. Of course, you realize that the payment of money can constitute valuable consideration, but this is not the only method. Legal consideration is also found in the mutual promises of the parties, if they surrender a legal right by making the promise.

Which contracts have to be in writing? You should understand that not **all** contracts can be enforced. The law says that certain types of contracts must be in writing to be enforceable. Among those are the following:

1. Contracts of executors or administrators who become personally responsible for the debts of the estates they are administering.

2. Contracts involving the sale of real estate.

3. Contracts to answer for the debt, default or miscarriage of another. For example, suppose **A** tells **B** to sell some equipment to **C** and agrees that, if **C** does not pay, he **(A)** will pay the bill. This promise of **A's** must be in writing to be enforced.

4. Agreements that may not, under their terms, be performed personally within one year. For example, suppose that **A** orally agrees to employ **B** as an engineer or an executive in a gas distribution company on January 1, 1960, work to start January 5, 1960. Neither party could enforce the agreement because it could not be performed within one year from the date it was made.

5. Agreements to sell personal property above a certain amount, usually $50 unless there has been part payment or part delivery.

Who has rights in a contract? Only the parties to a contract have any rights or duties under same. All rights under a contract may be assigned, however, without the consent of the other party, if the contract has not been made nonassignable by its terms.

If disagreement arises between the parties to a contract and the controversy goes to court, the court will decide whether or not a contract actually exists, and, if it does, what the rights and duties of the parties are under the contract.

When is a contract discharged?

Business contracts are discharged by performance, agreement of both parties, impossibility of performance, and by operation of law.

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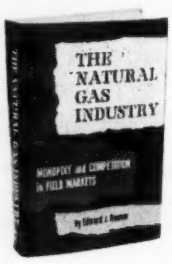

THE NATURAL GAS INDUSTRY
Monopoly and Competition in Field Markets
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But, a *breach* of a contract by one of the parties involved, gives the other a right of action for damages and, under certain conditions, will discharge him from further duty to perform.

You should, at the least, keep a copy of every business contract you make for your company. Without a genuine copy, you may have difficulty proving what the contract actually involved.

Before you enter into any business contract for your company, you should be sure it is clear and understandable. It should contain all the details intended to govern the business transaction. In the eyes of the law, there can be but one contract, and any changes in it involve hazards leading to possible trouble later on.

The law of sales

Law governs your company sales transactions. The time to look at the law is *beforehand*—not after you may have committed the company to an action that could have costly consequences of which you are unaware.

You will understand this better if you know some basic facts about sales law. Here is some information for your guidance. It provides some basic rules pertaining to sales, as a measure of preventive laws, in an effort to help your company avoid possible legal pitfalls.

Tangible personal property is commonly referred to as *chattels* and includes those items of personal property which we can use. *Intangible personal property* is technically known as *choices in action* and includes those items of personal property that we cannot see. They are legal rights that the owner has against others. When we use the term *goods and merchandise* we are referring to chattels or tangible personal property.

The selling of goods comes within the provision of, and is governed by, what is known as the Uniform Sales Act. Today, about 34 states and the District of Columbia have adopted the Uniform Sales Act. The remaining states have separate laws regulating the making of sales.

You can understand the law of sales when you know what constitutes "a sale" and how it differs from a "contract to sell."

To distinguish the differences, you should keep in mind that a sale of goods is an agreement whereby the seller transfers the property in goods to the buyer for a consideration called price. By property is meant the ownership or title to the goods. Thus, in the case of a sale, the title passes at once.

But, a contract to sell is a contract whereby the seller agrees to transfer the property in goods to the buyer for a consideration called price. In the case of a contract to sell, passage of the title to the goods from the seller to the buyer takes place at some future date.

Your warranties

In order to induce a buyer to purchase your goods, as a seller, you probably make certain representations covering your goods. Such representations are usually held to be warranties. If, however, your representations are false and you (the seller) know or must know if they are false, and your buyer relies on such representations and purchases your goods, as the seller you may be liable to the buyer for damages.

The terms *warranty* and *guaranty* often seem to be understood by some people in business as being synonymous, yet they differ materially.

There are two types of warranties, namely, *express and implied warranties.*

To simplify this, remember that the law provides that any affirmation of fact or promise by the seller relating to the goods is an *express warranty* if the natural tendency of such affirmation or promise is to induce the buyer to purchase the goods and if the buyer purchases the goods relying on your promises.

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On the other hand, keep in mind that no affirmation of the *value* of the goods, nor any statement purporting to be a statement of the seller's *opinion* only, can be construed as a warranty.

If it can be shown, however, that the buyer purchased your goods, relying upon his *own* judgment and not upon your representations as the seller, the buyer may be unable to recover judgment against you for the alleged breach of an implied warranty. In short, a mere affirmation or statement of the seller of his *opinion* as to the value of the goods does not constitute a warranty.

Suppose, as a seller, you merely say to the buyer that your merchandise is worth much more than you are asking? No warranty is created.

Suppose you make a general statement like, "a good buy" or "this cannot be duplicated for double the money?" Such statements are held to be *sales talk* or *puffing*. You may keep on using them—but be sure that they are facts.

A *guaranty contract* is not the same as a warranty contract. A guaranty contract has nothing to do with the quality of the goods sold; in fact, it has very little direct bearing upon the sale of goods. In the case of a guaranty contract, *A* enters into a contract with *B* whereby *A* says to *B* that if *B* will extend credit to *C* and if *C* does not pay *B*, then *A* will pay *B*. A guaranty contract has to be in writing to be enforceable.

Implied warranty. The law implies that the seller of goods makes certain warranties in his sales contracts, even though such warranties were not actually or expressly made by him. The type of warranty implied in a given sales contract depends upon the nature of the contract.

One type of warranty implied in a given sales contract in almost every sale, or contract to sell goods, namely, is an *implied warranty of title*. This means that unless you (the seller) expressly state that some lien or encumberance stands against the goods, it will be implied that you (the seller) are the owner of the property, that the property is free from any lien or encumberance, and that you (the seller) have a legal right to sell same.

In certain types of sales contracts to sell there is an *implied warranty of suitability*. If the buyer expressly or impliedly conveys to the seller the purpose for which he wishes to use the product and the buyer relies on the seller's skill and judgment in selecting the goods, the law implies that the seller by implication warrants that the goods purchased will be suitable and fit for the purpose for which the buyer intends to use same.

In some types of sales contracts, there is an *implied warranty of merchantability*. In short, goods are said to be merchantable if they are capable of being sold in the existing market and in the regular course of business.

If your goods are sold by sample or by description, there is an implied warranty that same will also correspond to the sample or to the description.

A general rule is that the warranties of a seller to a buyer do not continue to be effective and binding against the seller if the buyer sells the goods to some other person.

When does title pass?

Should a controversy arise between your company as the seller and the buyer it becomes important to know when the title passes because it is a big question in the law of sales. In the determination of this matter, as a general rule the title passes whenever the parties agree that it shall pass.

The sales act, however, says that where there is a contract to sell specific or ascertained goods, the property in them is transferred to the buyer at such time as the parties to the contract intend it to be transferred. For the purpose of ascertaining the intention of the parties involved, regard shall be had to the terms of the contract, conduct of the parties, usages of trade, and circumstances of the case.

In short, if the buyer and seller always keep the importance of this matter in mind and specify in their sales contract when title is to pass, seldom would any difficulty arise.

Sales transactions

If your goods are shipped f.o.b. point of shipment (freight on bill) the title passes when the goods are turned over to the carrier.

If the goods are shipped f.o.b. destination, the title would not pass until the goods are delivered to the buyer. In the first instance, the buyer pays the costs of transportation while in the second instance the seller pays the costs of transportation.

In the case of a c.i.f. transaction, the buyer agrees to pay a lump sum that includes (c) cost of the goods, (i) insurance, and (f) the freight. It is provided in the sales act that in the case of a c.i.f. transaction, the title to the goods passes to the buyer as soon as the goods are delivered to the carrier.

Rights and remedies

An unpaid seller of goods has certain remedies that he may exercise against the buyer. If the title to the goods has passed to the buyer, he has a lien on the goods, he has a right of stoppage in transit, and he also has a right to resell the goods.

Under certain conditions, an unpaid seller of goods has a right of stoppage

in transit. The following conditions must exist, however, before the seller may exercise this right of stoppage in transit:

1) The goods must be in transit, and
2) The buyer must be insolvent.

In addition, an unpaid seller of goods has certain remedies against the buyer for the breach of the sales contract. He may bring an action against the buyer for the contract price, under proper conditions he may sue for damages for non-acceptance, and he also has a right to rescind the sales contract and sue for damages.

On the other hand under proper conditions the buyer has the following remedies against the seller. He has a right to sue the seller for converting or detaining the goods, he may sue the seller for failing to deliver, and, in some cases, he may bring a suit in equity for performance of the sales contract.

Other pointers. It goes without saying that the seller of goods must deliver, and the buyer must accept the goods to effect a sale, and, of course, in accordance with the terms of the sales contract. The place, time, and manner of delivery depend upon the parties involved.

The buyer has a right to inspect and examine the goods when delivered to him. If there is a delivery of wrong quantity, the buyer may reject the goods. A buyer is held to have accepted the goods if they are tendered to him and he intimates to the seller that he has accepted them or, if the goods have been delivered to him.

If the seller is ready and willing to deliver the goods, and the buyer does not accept delivery within a reasonable time in accordance with the terms of the sales contract, the buyer may be liable for a reasonable charge for the care and custody of the goods.

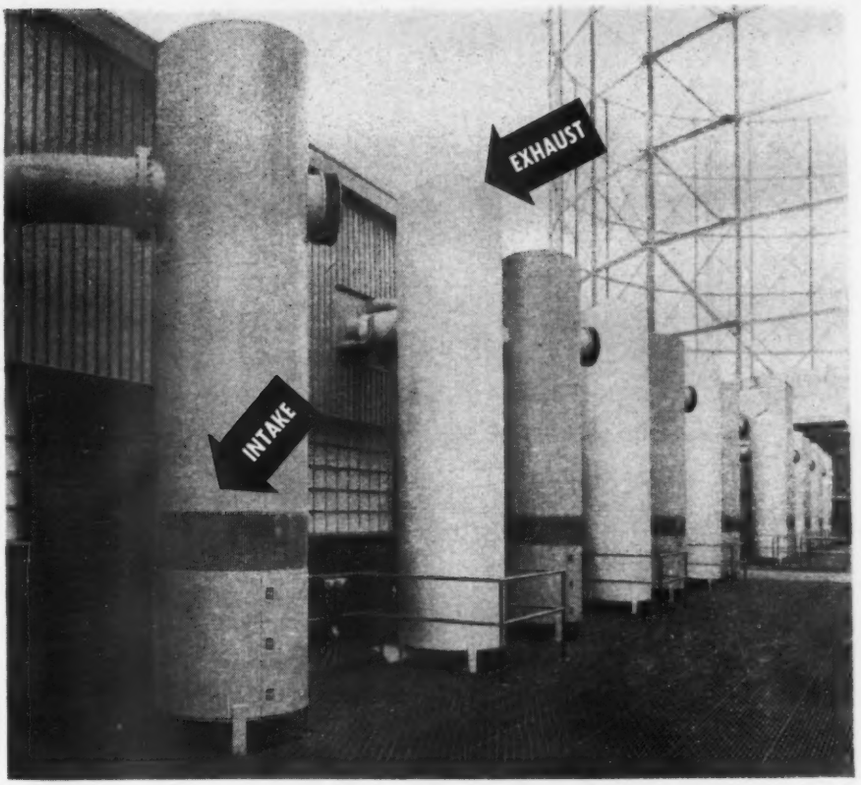
In selling and buying, both parties should agree on all legal points of a sale or a contract to sell. *If your sales contracts are tested by legal principles of contract law, would they be enforceable?*

You, therefore, should incorporate in your sales contracts all material points so that you may define your company's legal rights or liabilities under the sales contract.

You should have your company lawyer examine all your sales contracts to see that they conform to lawful requirements. By so doing, you will be better able to sell more efficiently and economically. In the meantime, you can know and understand your rights and obligations.

The old adage that it is better to be safe than sorry can find no better illustration than knowing all you can about sales law.

* * *



Eight SILENT TWINS Team Up To Eliminate Neighborhood Noise At California Gas Compressor Station

Rigid noise level requirements were issued by Southern California Gas Company for their Ducommun Street Station in the heart of Los Angeles. Burgess-Manning designed to the specifications, and guaranteed the performance of eight Silent Twins that were installed on each of eight Ingersoll-Rand gas engine driven compressors in the plant.

Silent Twins, matched units for remote-mounted or engine-mounted turbochargers, provide clean, filtered intake air at minimum pressure drop and maximum silencing efficiency on both the intake and exhaust sides of the system. Available for vertical or horizontal installation, they afford flow-conditioned, compact piping for best operating efficiency.

Silent Twins can be furnished with either two types of filters: a petrolatum-treated hogshair, used on the Gulf Coast, the Eastern United States, and other light dust load areas; for heavy dust load areas, we recommend a special felt material that will hold or load up with dust and dirt of a very small micron size.

Burgess-Manning Silencers are scientifically engineered to prevent — not muffle — exhaust noise of internal combustion engines, discharge of rotary blowers, and the intake of reciprocating compressors and rotary blowers. Silencing is obtained by passing the flow through snubbing chambers so that it is discharged to atmosphere smoothly and quietly. Burgess-Manning Snubbers are built like pressure vessels, continuously welded throughout, without excessive weight. A wide range of both standard and special units is available for 1" through 30" and larger pipe sizes.

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Terminus of Laclede Gas Company's new propane line is surveyed by John Adolphson. Arriving by products pipeline, the liquid propane is stored in tanks at Laclede's Catalan Street Station in St. Louis until needed for peak shaving; the propane can also be used directly from the pipeline.

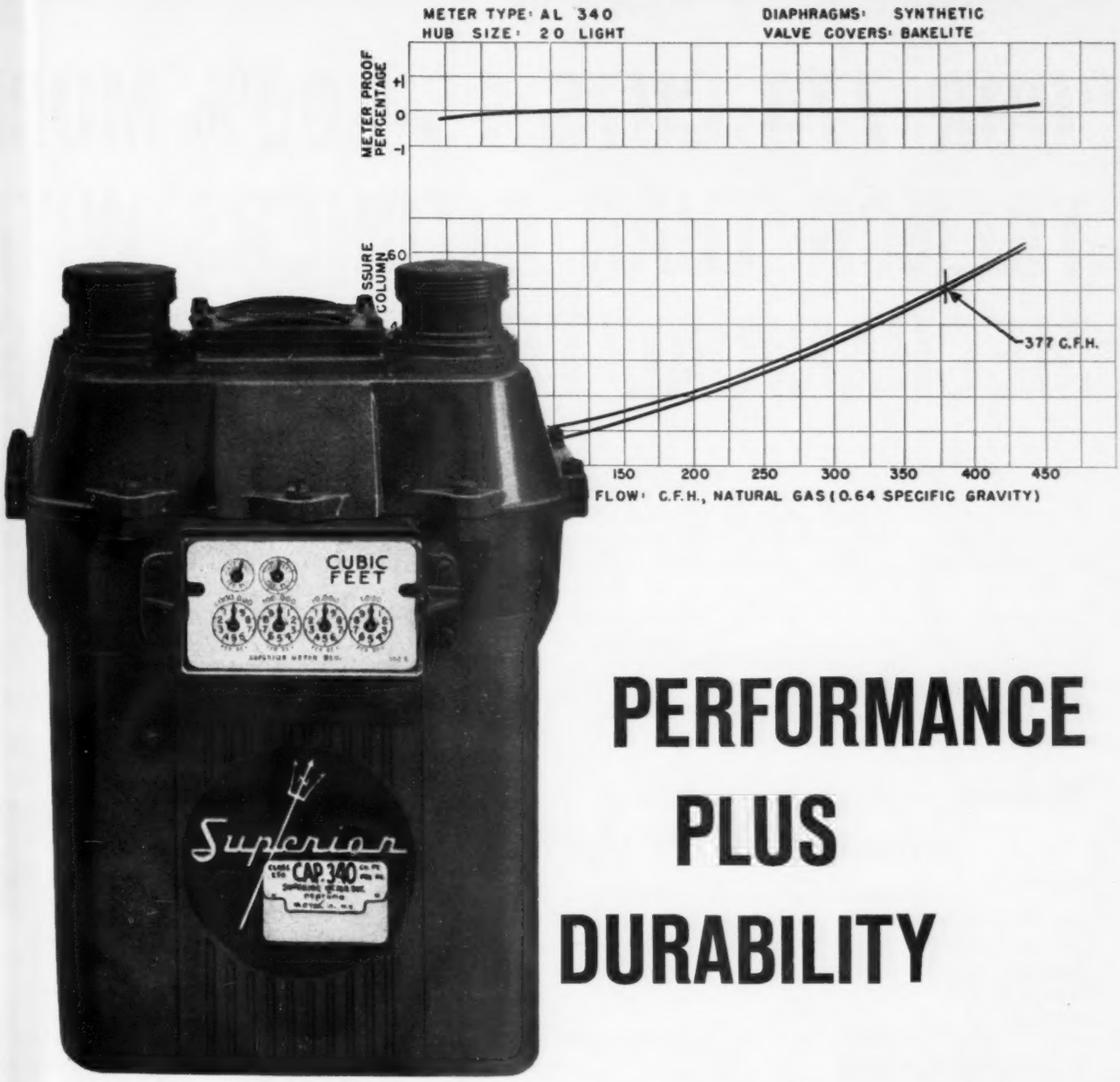
Iowa Public Service Company, Sioux City, Iowa, has notified Northern Natural Gas Company of Omaha that it is willing to share the cost of building border stations and pipelines to bring natural gas service to various towns in its service area. Ordinarily, the distributor builds only the local distribution system and the transmission company pays the entire cost of metering stations and branch lines. But when the FPC approved gas supplies for IPS towns last summer it held that some of them would not offer sufficient business potential to justify Northern paying for a meter station and in some cases all pipeline expense. It said service would be feasible only if IPS were willing to pay for the metering station and in some cases part of the branch supply line expense. In all, IPS has agreed to share costs for 33 towns at an estimated cost of $484,181.

DISTRIBUTION DEVELOPMENTS

NEWS ABOUT CURRENT AND PLANNED CONSTRUCTION

Central Hudson Gas and Electric Company, Poughkeepsie, New York has completed three major main extension projects. Approximately $30,000 has been spent on distribution mains and a gas regulator station to supply natural gas to 20 homes in Central Valley in the town of Woodbury. The small residential hamlet located about 16 miles south of Newburgh, will be served from the company's Tuxedo Park to Poughkeepsie gas supply main that passes near the village. Also, two new housing developments in Highland and near Fishkill have been added to Central Hudson's system. All installation work including 25 services has been completed to serve the Hudson Hills development from the newly-constructed main on Route 9W in Highland. Work has also been completed on the gas main extension to serve a new development at Brinckerhoff in the town of Fishkill. Approximately 9,400 ft of 6-in. and 8000 ft of 8-in. have been installed. The new main extends from an existing line at Forgebrook Meadows to the new development located along Route 52 and Route 82. The project will eventually contain 800 homes.

Construction crews of New York State Electric and Gas Corporation walk softly as the 150 ft section of 10-in. gas line slithers through the quicksand in a highway relocation project just north of the Lehigh Valley Railroad overpass near Geneva. The line, one of two main sources for natural gas for the city, was lowered 12 ft below the site of a new bypass for Routes 5 and 20. Quicksand in the soil made it necessary to shore excavation walls with steel pilings and heavy timbers.



PERFORMANCE PLUS DURABILITY

It's easy to prove the top-notch performance and rugged durability of Superior Aluminum Case Gas Meters on your own test bench.

Look for low differential fluctuation of the water column, and straight-line accuracy on the prover. They are your evidence of smooth performance.

Smooth performance, coupled with Superior's carefully engineered construction, means long-term accuracy. A recent field test has shown no visual evidence of wear in any parts after registration of over 3,500,000 cu. ft.... the equivalent of over 20 years in service.

For complete information on Superior's line of Aluminum Case Gas Meters send for Bulletin 1150... or tell us when a Superior representative may call.

P.S. Nationwide sales, service and warehousing facilities are available on all Superior products, to meet utility metering needs. You can specify "Superior" with confidence.

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Texas utilities contractor reports:

"OUR 774 CUTS 25-200% MORE TRENCH THAN DITCHERS WITH MECHANICAL TRANSMISSIONS"

"We know for a fact our Barber-Greene 774 Ditcher with dual-range Hydra-Crowd transmission cuts 25 to 200% more ditch daily than mechanical transmission ditchers we've used," says H. W. McCurley, of Pearson & McCurley, Beaumont, Texas, utilities contractors.

"Actually the 774 revolutionizes ditcher design with a hydraulic control system that gives the operator fingertip control of forward crowding speeds, boom hoist, discharge conveyor drive . . . all independent of wheel digging speeds. And our operator sure likes the instant dialing of maximum crowding speed for any ground condition.

NO PARTS REPLACEMENT—"In ditching 36,000 feet, we've had no parts replacement . . . never changed digging teeth, side cutters or gumbo cutting lips on fingerback buckets," he recalls.

This Texas firm bought its 774 after renting one from a contractor. Your Barber-Greene Distributor will take you to a job and show you the ditcher you are interested in so you'll get all the facts. Call him today.

Midwest utility company
OWNS FLEET OF OVER 25 BARBER-GREENES

This Barber-Greene dug in record time the street mains and over 300 services in one subdivision, keeping well ahead of the crew that was welding, wrapping and lowering in. Owned by a major midwestern gas utility, the Model 773 shown below is only one of the more than 25 Barber-Greene Ditchers in their fleet.

For close quarter operation, Barber-Greene's 772, identical with the 773 except for narrower track gauge and pad width, works within 19" of side obstructions. All three utility ditchers have dual-range Hydra-Crowd transmission, exclusive digging wheel drive with fully guarded chains, automatic overload protection, shock-absorbing flexible drawbar, hydraulically driven spoil conveyor with rubber-impact rollers, and fewest wearing parts for minimum maintenance. Model 774 is available with 5½ or 7 wheels and cuts from 18-30" wide. Models 773 and 772 trench to 5½' deep and 10-24" wide.

On jobs in Beaumont and Orange, Texas, installing pipe from 8" to 16", Pearson & McCurley's 774 with 5½-ft. wheel dug up to 2,500-ft. daily in tough gulf coast gumbo. "Has plenty of reserve to dig far beyond our daily needs," says Mr. McCurley.

Rubber-tired or crawler mounted Barber-Greene Vertical Boom Ditchers cut lowest cost trench from 5½" to 24" wide and to 7' deep. Model 705-B, shown, digs to 4'8" deep.

Manufacturer of the only modern ditcher line

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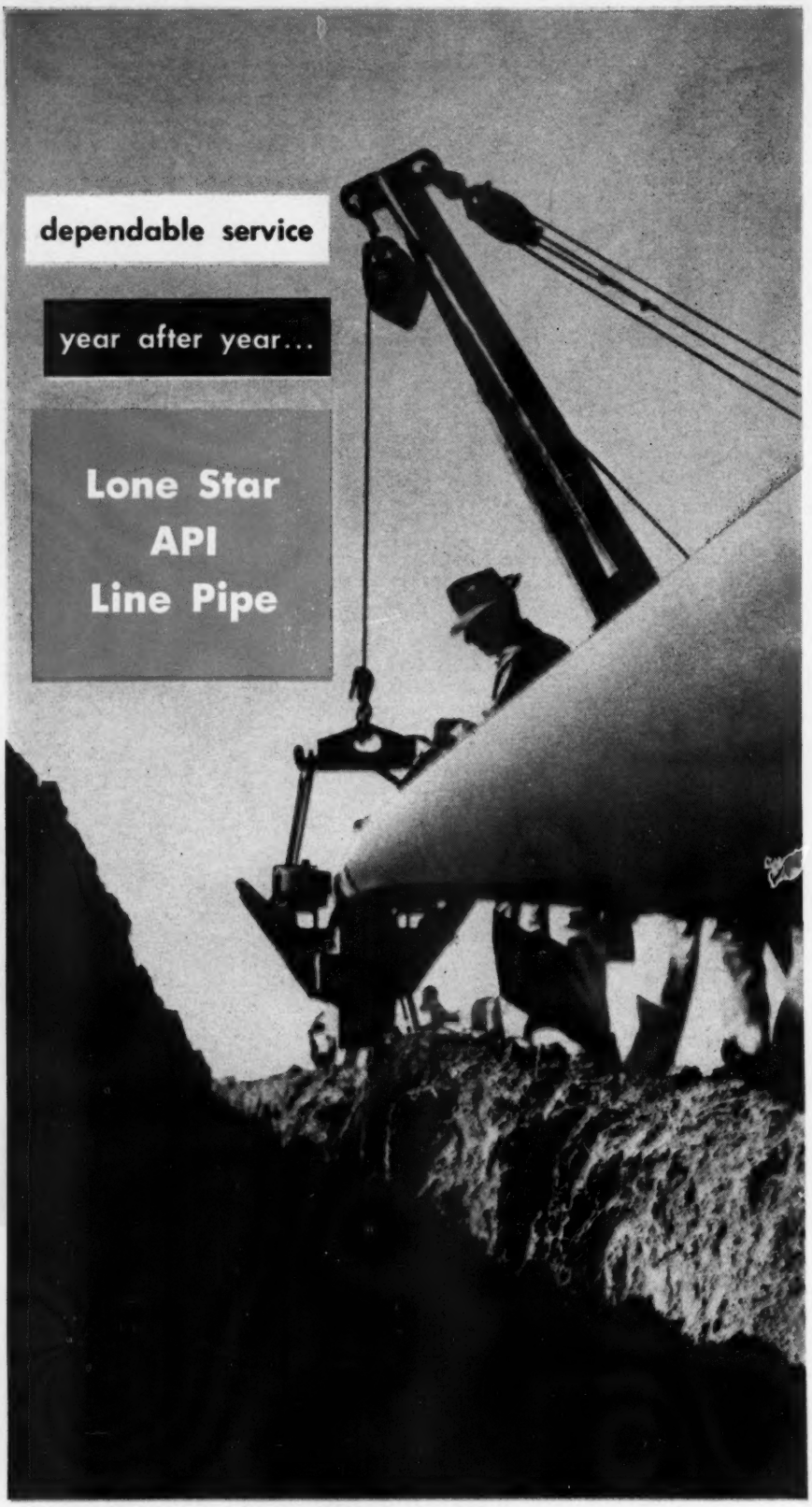

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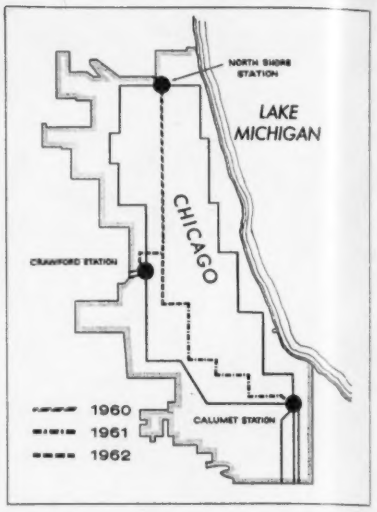


Peoples Gas Light and Coke Company, Chicago, during 1960 will construct the first section of a 29-mile, 36-in. steel main from its North Shore Station to its Calumet Station on the far south side of Chicago. The new line will intersect People's existing 36 and 48-in. medium pressure loop main (solid black line on map above) that encircles the city and interconnects with various distribution pumping stations. The new loop will also directly connect the three stations at which the company receives natural gas. Estimated to cost $23,500,000, the project will provide a necessary increase in capacity of the present distribution system and permit greater flexibility in meeting peak demands. During 1960, 41,600 ft of 36-in. will be laid at a cost of about $6,000,000. Second phase, to be built in 1961, will be the 60,700-ft south portion, to cost $9,000,000. A final section to be built in 1962 will link the north and south sections and will require 53,000 ft of line at a cost of $8,500,000, including a connecting main to Crawford Station.

Washington Natural Gas Company, Seattle, Washington, spent $6,102,500 during 1959 for the installation of 197 miles of new main and 7725 new services plus the re-activation of 1629 services.

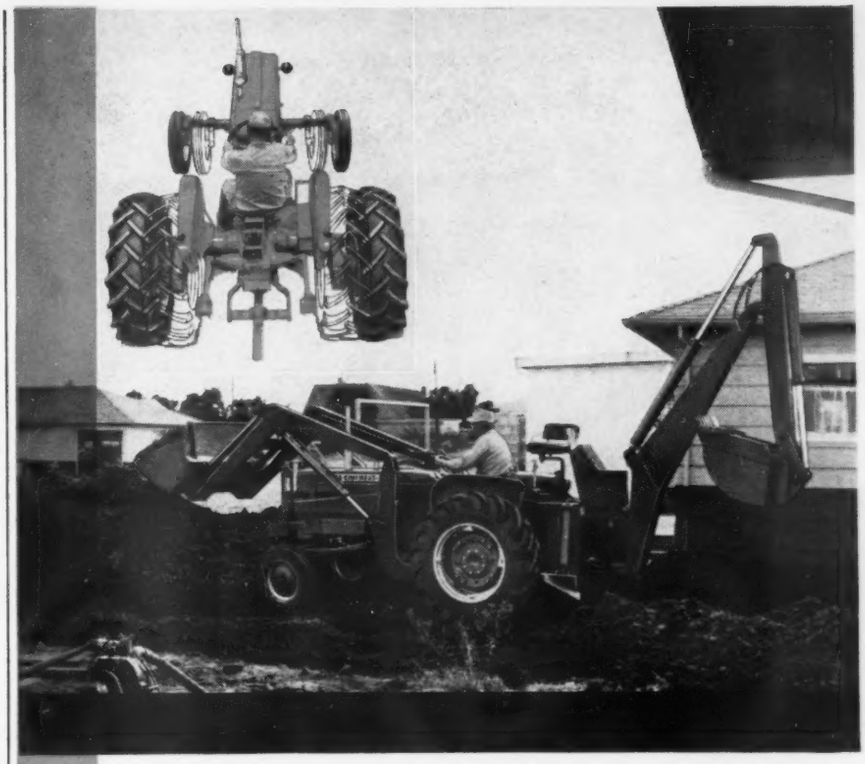
Arkansas Western Gas Company, Fayetteville, Arkansas, has budgeted $493,000 for extensions of mains and services during 1960. Another $65,000 has been allocated for automotive equipment, tools, and work equipment for the company. During 1959, Arkansas Western added 1423 new gas customers bringing its total number of gas customers to 33,042. Company presently serves 41 incorporated towns and cities and 16 un-incorporated towns and communities in Arkansas. It is estimated that 25 percent of Arkansas Western's customers are rural.

Developments

Wisconsin Public Service Corporation, Milwaukee, Wisconsin, has allocated approximately $1,000,000 for service facilities in the Stevens Point, Oconto, and Peshtigo, Wisconsin, areas and in the Menominee-Marinette area to provide for conversion of systems to natural gas. Michigan Wisconsin Pipe Line Company recently received FPC authorization to provide gas for these locations, pending "okay" from Canadian officials for export of gas from Canada. This additional supply of gas will be helpful not only in improving earnings where 12 percent of Wisconsin Public Service's customers are served with manufactured gas, but in increasing gas supply to existing natural gas territory where more gas to serve new space heating customers has been needed for several years. Volume of gas sold in 1959 totaled 9,870,000,000 cu ft, an increase of 20.4 percent, with all classes of service showing substantial gains. Additional supplies of natural gas, which became available in June, 1959, resulted in the allocation of 3863 new space heating permits and an increase in the total number of authorized space heating customers to 27,710. Space heating customers account for approximately 46 percent of Wisconsin Public Service's natural gas customers; total number of company's gas customers at year's end was 68,876.

Rio Grande Gas Company, Las Cruces, New Mexico, has been authorized by the New Mexico Public Service Commission to build a 27-mile line to Dona Ana County to serve approximately 900 customers.

Southern Union Gas Company, Dallas, Texas, has completed a natural gas line extension in the Los Lunas-Peralta, New Mexico, area to serve approximately 200 new customers. Project involved approximately five miles of 4-in. main in addition to services to the property lines of the 200 customers. The extension ties into the company's Belen-Albuquerque main west of the Rio Grande, crosses the river along Highway 47, circles the "Y" at Valencia, and extends northeast through Valencia and Peralta to the southern edge of Bosque Farms. Contractor was Mermis Construction Co. of Albuquerque and Artesia. Another project recently completed involved installation of a 3500 ft gas line to the new Santa Cruz elementary school at Sombrillo, New Mexico. The line, which runs from Espanola mains near the Santa Fe highway, will supply an estimated 500,000 cu ft of gas a month to the new school during the peak months of the heating season.



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Automatically? The nearest thing to it, and you'll find it only on Allis-Chalmers D-Series utility tractors. Power-Shift rear wheels move out wide for extra stability . . . pull in for close work just as easily. Roll-Shift front axle on the D-14 and D-17 moves wheels in or out in seconds—you don't have to take chances with a narrow wheel tread!

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What size do you need? It doesn't cost to get the facts!

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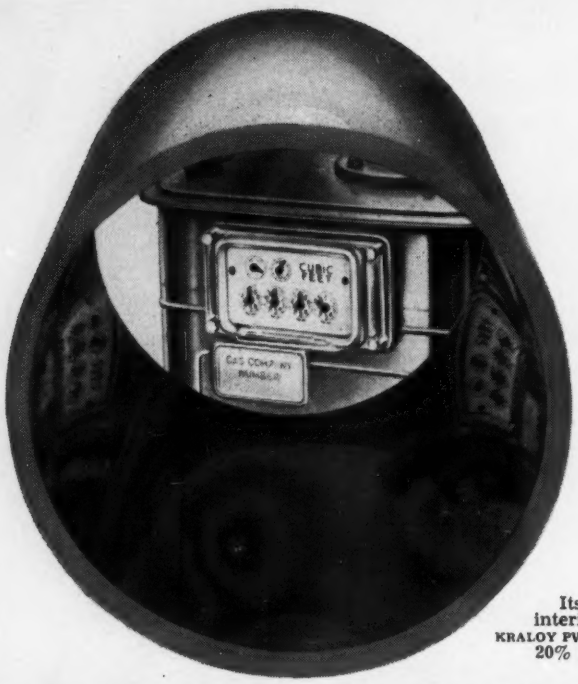

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PIPE MORE GAS, CLEANER GAS CUT CORROSION-REPAIR COSTS WITH KRALOY PVC PLASTIC PIPE

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Not affected by electrolytic action, KRALOY defies scale buildup and ground or chemical actions. Inert, corrosion-proof, KRALOY PVC *never needs painting or cathodic protection* – ends "holiday hunts" and cuts maintenance costs to the absolute minimum. Precision extruded with mirror-smooth walls for greater thru-put, free-flow KRALOY'S unchanging quality is insured by continuous rigid laboratory control. Available in all sizes from ¼" to 12" with plastic valves and fittings.

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Distribution Developments

Iowa Electric Light and Power Company, Cedar Rapids, Iowa, has completed a new distribution system in Orient, consisting of 25,000 ft of gas main and 152 service lines. Company plans to start construction on new gas distribution systems in 25 Iowa towns early in the spring of 1960. FPC recently granted Northern Natural Gas Company authority to provide natural gas service to 169 Iowa towns including 25 in which Iowa Electric Light and Power Company holds franchises. The towns in which Iowa is authorized to distribute gas are: Corwith, Hazelton, Oelwein, Goodell, Alexander, Meservey, Hubbard, Kanawha, Roland, Sibley, Ashton, George, Tama, Dysart, Garwin, Gladbrook, Toledo, Traer, Vinton, Garrison, Wellsburg, Winthrop, Owasa, Gilbert and Holland. Company budgeted approximately $1,776,304 for gas distribution in 1959 anticipating the okay from the FPC and extension of service to the new communities. About $60,000,000 of this amount has already been spent in Oelwein and the town is ready to receive natural gas as soon as the supplying pipeline company can extend its transmission system.

Charleston Group of the Columbia Gas System, Charleston, West Virginia, (which includes the United Fuel Gas Company, Amere Gas Utilities Company, Columbia Gas of Kentucky, Inc., and Virginia Gas Distribution Corporation) plans to spend approximately $4,500,000 in 1960 for distribution construction. Major projects include a $200,000 part replacement of Line "KT" serving Frankfort, Kentucky; a $69,300 6-in. line from Wurtland to Worthington, Kentucky and a $65,800 part replacement of the Staunton, Virginia, lateral line.

Also planned for 1960, is the beginning of an intergroup microwave system. Station sites have been selected and roads constructed; first equipment is scheduled to be installed on Charleston Group properties in 1960 at an estimated cost of $645,000.

Another project planned for 1960 is the conversion of Terra Alta into an underground storage pool with total investment in the project, including gas cushion, estimated to be about $25,000,000. Approximately $18,000,000 of this to be spent in 1960. A 43-mile, 20-in. line from Seneca compressor station to the storage pool site will cost approximately $3,700,000; the compressor station and dehydration plant another $2,500,000. Addition of the Terra Alta Storage field will increase the Charleston Group companies' storage capacity by 16.7 billion cu ft.

Ditching machine cuts pathway for $181,500 Ohio Fuel line to extend gas service in Cedar Point (in northern Ohio) to more than 200 homes and 14 commercial establishments and for a proposed residential development at the resort area.

Boring machine tunnels beneath roadway in southeast section of Springfield, Ohio, during construction of $7700 Ohio Fuel Gas Company project to improve natural gas service in that area of the central Ohio city.

Ohio Fuel Gas Company and **Ohio Valley Gas Company,** Columbus, Ohio, plan to spend more than $25,000,000 for new construction in 1960. Of this total budget, more than $15,000,000 will be used by the distribution department to improve natural gas facilities for more than 796,000 customers in 510 Ohio communities. More than $26,000,000 was invested in new construction in 1959, with 64 percent going to improve distribution department facilities. These outlays bring the total cost of Ohio Fuel's construction and improvement program since 1950 to $226,000,000.

The Gas Service Company, Kansas City, Missouri, added 16,973 residential customers or 3.0 percent increase during 1959 bringing the total number of residential customers served as of the year's end to 582,221. Fastest growing division was Lee's Summit, which added 2495 customers for a 10.5 percent increase. Mission was second with a 2651 or 7.5 percent increase, and Independence, Missouri, was third with 1863 additional customers or 7.3 percent increase.

Nature's First Gas Detection Device!

And, still one of the most useful indicators of Gas leakage. The characteristics of leaves, grass and other vegetation give the trained observer accurate information and valuable indications of the presence of Gas leakage in residential and outlying areas. Expert examination and analysis of vegetation and soil conditions gives equally valuable information in pinpointing areas where Gas leaks do *not* exist, But — infallible accuracy in finding Gas leaks *demands* more.

Heath V Type Leakage Control Surveys take the guess-work out of nature

More than 25 years of experience under all kinds of conditions have gone into the development and perfection of the Heath V Type Leakage Control Surveys. The unique, first in the field, Heath System combines use of the most modern testing devices, complete inspection and analysis of vegetation and soil conditions by recognized experts with highly specialized training.

Heath V Type Leakage Control Surveys result in Safety - Savings - Efficiency

Your System will benefit from greater safety by having leakage found and classified before trouble develops. Savings will result as your "unaccounted for" factor diminishes. Greater efficiency in programming your maintenance and repair crews are realized and economies accrue from "anticipation of need."

For complete information on how a HEATH V TYPE LEAKAGE CONTROL SURVEY can benefit your Company, contact us at —

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The Safety Service That Saves Gas

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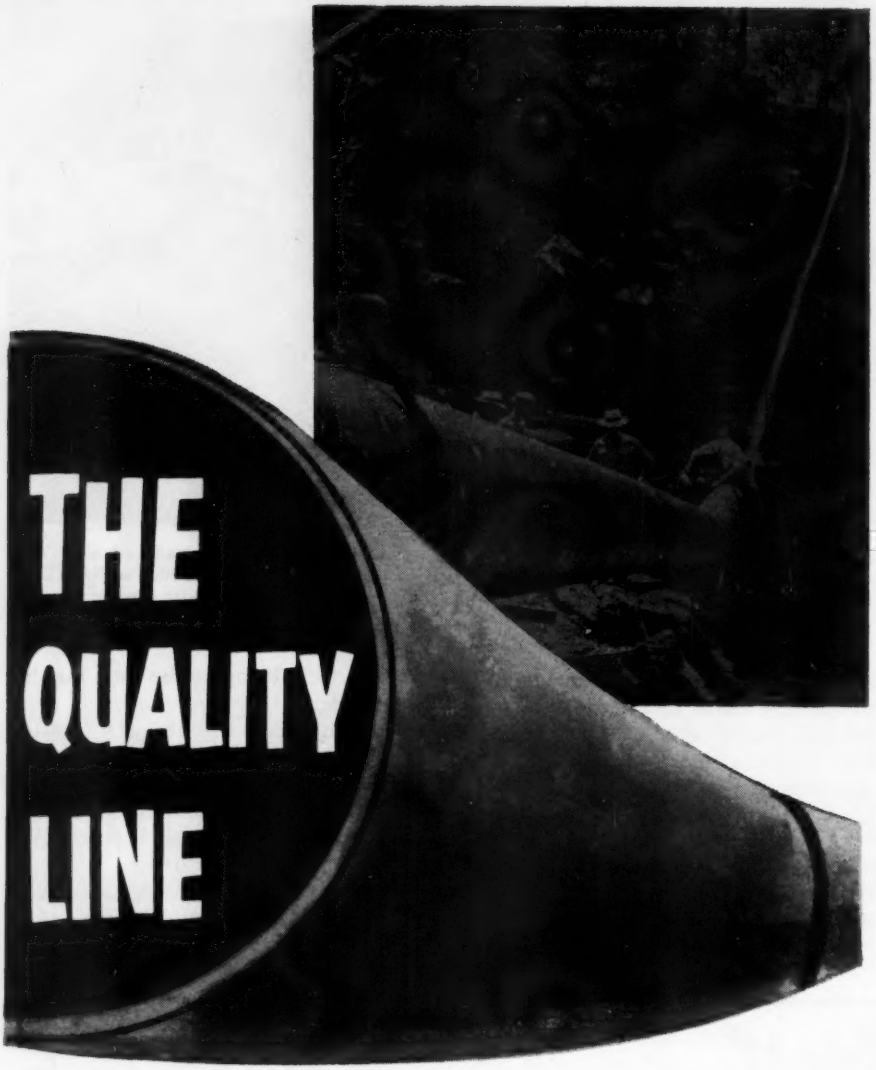

LATEX QUALITY PIPELINES BRING REPEAT BUSINESS

For over a quarter of a century the Quality line has been synonymous with the name *LATEX*. *LATEX* is renowned for their ability to build quality line rapidly and efficiently.

REMEMBER, LATEX QUALITY BRINGS REPEAT BUSINESS "AGAIN AND AGAIN"

LATEX
SERVING 1/4 CENTURY

Another quality service of *LATEX* is CONSTRUCTION OF PEAK SHAVING PLANTS. Pictured here is Atlanta Gas Light Company's Riverdale peak shaving plant near Atlanta.

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COMING EVENTS IN THE GAS DISTRIBUTION INDUSTRY

May

1- 4 LPGA annual convention and trade show, Conrad Hilton Hotel, Chicago, Illinois.

2- 6 PCGA Industrial Gas Sales School, Hotel Sainte Claire, San Jose, California.

9-12 National Restaurant Show, Navy Pier, Chicago, Illinois.

9-12 A.G.A. Commercial Gas Sales School, Edgewater Beach Hotel, Chicago, Illinois.

9-12 ISA instrument-automation conference, San Francisco, California.

9-13 A.G.A. Operating Section Joint Distribution and Transmission Conference, Hotels Roosevelt and Jung, New Orleans, Louisiana.

11-12 Gas Conditioning Institute, National Guard Armory, Liberal, Kansas. Sponsored by the University of Kansas.

12-13 A.G.A. eastern gas sales conference, Shoreham Hotel, Washington, D.C.

15-17 Wisconsin Utilities Association, accounting conference, Lake Lawn Lodge, Delavan, Wisconsin.

16-18 A.G.A. mid-west regional gas sales conference, Edgewater Beach Hotel, Chicago, Illinois.

16-20 National Fire Protection Association, annual meeting, Montreal, Canada.

22-26 ASME, Oil & Gas Power Conference, Muehlebach Hotel, Kansas City, Missouri.

23-24 A.G.A. Operating Section Production Conference, Hotel Roosevelt, New York, New York.

24-26 Pennsylvania Gas Association, annual meeting, Pocono Manor, Pennsylvania.

26-27 The Natural Gas & Petroleum Association of Canada, Niagara Falls, Ontario, Canada.

June

1- 3 Texas College of Arts and Industries, fifteenth annual Short Course in Gas Technology sponsored by the Southern Gas Association. Kingsville, Texas.

1- 3 Fifth Annual Appalachian Underground Corrosion Short Course, West Virginia University, Morgantown, West Virginia.

6- 7 PCGA-A.G.A. Research & Utilization conference, Miramar Hotel, Santa Monica, California.

9-10 PCGA customer service conference, Miramar Hotel, Santa Monica, California.

22-25 Canadian Gas Association, 53rd annual meeting, Manoir Richelieu, Murray Bay, Quebec.

27-28 Michigan Gas Association, Grand Hotel, Mackinac Island, Michigan.

July

24-Aug. 5 Ninth Annual Utility Management Workshop, Arden House, Harriman Campus, Columbia University, Harriman, New York.

August

17-19 Mid-West Gas Association gas school and conference, Iowa State College, Ames, Iowa.

install **MUELLER**® *Extension Stopper Fittings*

■ Plan ahead for future system expansion by installing Mueller Extension Stopper Fittings **at the time the main is laid.**
When extending the main just follow these four simple steps:

1. Stop-off fitting with Mueller Line Stopping Equipment. (No drilling needed!)
2. Cut off capped end of fitting.
3. Weld new main to fitting.
4. Remove stopper and "button up" fitting.*

All of these operations are performed quickly and in complete safety. There is no interruption of service on the existing main. Remember these fittings when laying your next main. They will save you time and undue expense when it later becomes necessary to extend the main.

**An equalizing and purging connection may be made between the by-pass of the stopping machine and the new extension by using a Mueller H-17490 Save-A-Valve Drilling Nipple.*

These fittings are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller No-Blo product made for the gas industry. Write for the complete information on other sizes and styles of Mueller Extension Stopper Fittings.

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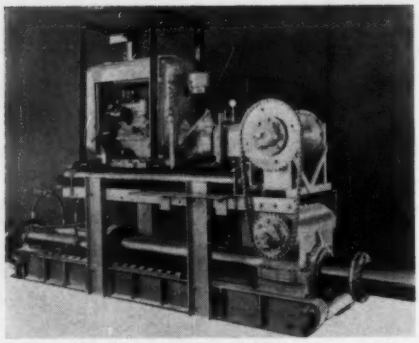


Under-road boring machine is now being made with power unit mounted directly above the boring unit to save setting up time and provide more efficient and trouble-free power transmission. Allows operator unobstructed vision and full control of boring operation from all sides. The 35 hp power unit, with 4-speed transmission and reverse, is mounted on its own pipe skid base, and is easily removed from boring unit when desired. New machine, manufactured by Young Engine Corp., bores and installs, in one operation, 6 to 30-in. casing, and in limited lengths, 36-in. diameter casings.

CIRCLE (3) ON THE REPLY CARD

Pipe marking device eliminates costly and time-consuming template drawings and shop handling. Tool uses a soapstone tip for marking directly onto either flat or curved working surfaces. Scribes ellipses ranging from 2½ to 3-in. minimum diameter to a 12 to 16-in. maximum diameter. Lateral and header markings for angles from 0 to 45 deg are easily made. Marker works equally well on flat or mutiple curved surfaces.

CIRCLE (4) ON THE REPLY CARD

Improved transistorized metal locator for locating shallow pipe, meter covers and valves features single turn transmitting and receiving coil cast right into the fiberglass case. Is now available from Gardiner Electronics Co. Transmitter and receiver are powered by 4 flashlight batteries each and have an average life of 1400 hours. Unit has the advantage of no ground pickup. Search coil may be held 4 ft or more off the ground and adjusted for operation, then lowered to within an inch of the ground and no change in sound or meter reading will be observed.

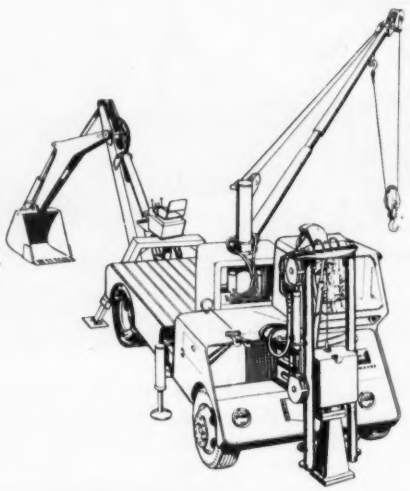
CIRCLE (5) ON THE REPLY CARD

Service saddle for gas lines, available from Joslyn Mfg. and Supply Co., applies uniform clamping pressure using a wide laminated strap, terminating in a short square bend "U" bolt at each end which provides a flexible tension member giving a closer fit regardless of variations in pipe diameter or pipe irregularities. Adaptable for use with all types of pipe within its rated size, including cast iron, steel, and transite. Considered safe for old pipe weakened by corrosion, two square bend "U" bolts provide uniform application of clamping force and eliminate problems of slippage and twisting common to other clamps.

CIRCLE (6) ON THE REPLY CARD

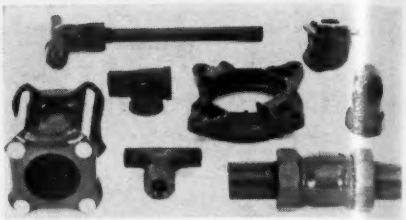
Lightweight, medium-horsepower gas turbine developed by Williams Research Corporation has a wide variety of uses. About the size of a breadbox, turbine weighs approximately 1 lb per horsepower or about ⅓ the weight per horsepower of other gas turbines. Turbine can be run on kerosine, aviation jet fuel, marine or automotive diesel fuels and straight gasolines. Employs new type of heat exchanger that uses the exhaust heat, normally wasted, by reintroducing it into the engine to make more efficient use of fuel. In effect, engine is partially powered by its own waste; the ultimate exhaust is cool enough to touch with the bare hand. Engine is vibrationless because of the absence of power impulses and reciprocating pistons; there is no piercing high frequency whine associated with aviation turbo-jet engine. Engine runs at a normal 58,500 rpm, but has been operated at around 61,000 rpm; power output shaft runs at around 5000 rpm.

CIRCLE (7) ON THE REPLY CARD



Ottawa Steel Division of Young Spring & Wire Corporation has introduced a new truck-tractor power unit that together with a set of matched power tools can handle a wide variety of construction jobs. Called the Commando, unit turns in a 24-ft circle; is available in 2 or 4-wheel drive, has speeds ranging from a controlled creep at full throttle up to 35 mph over-the-road. Weighs 9200 lb. Each of the "Uni-Tools" available for the new tractor becomes a completely self-contained, self-propelled unit when mounted on the Commando. The Hydra-Hammer, a breaker-tamper-pile driver unit handles concrete breaking, cuts asphalt, tamps fill. It works the full machine width without tilting the tower; can tamp a swath 10 ft wide and has creep speeds from 0 to 100 ft per minute. The Commando backhoe unit digs 12½ ft deep in any position of a 190 deg swing. Like other Ottawa backhoes, the Commando has "one-trols" which combine all lift, dump, dig, lower, crowd, and swing operations into two levers. The power crane unit (also shown in the picture above) handles pipe, industrial meters, etc. Available in capacities up to 7000 lb; has a full 360 rotation. Other tools include: dozer for earthmoving and materials handling, fork lift, and snow plow.

CIRCLE (8) ON THE REPLY CARD



Epoxy resin pipe coating that can be applied more easily and quickly than conventional mill coatings, at a competitive price, has been announced by Minnesota Mining and Manufacturing Co. The one-part powder resin called "Scotchkote," cures in less than 20 seconds with close coating tolerances, applies evenly to all surfaces, providing a finish with high electrical and mechanical strength. Solvent hazards and post baking, normally associated with epoxies, are eliminated. Upon application, the resin is completely thermoset, will not flow under pressure nor flow upon heating. It has an adhesion strength of 3000 psi, and high impact strength that resists damage from soil or pipe movement, and the abrasion and shock of back-filling. It resists attack by most chemicals, including hydrocarbons such as fuel oil, gasoline, kerosine, and sweet or sour crude. In salt crock tests, resistance of the coating remained at a constantly high level for 2-year periods of immersion under both anodic and cathodic conditions. Mill application of coating is a 4-step process including cleaning, heating, coating, and jeeping the pipe. Lab models or resin coating equipment designed by 3M have shown that continuous application of the resin to irregularly shaped objects is economical and practical, with the use of portable, inexpensive equipment. In addition to use as a pipe protection coating, the epoxy resin can be applied to fittings, meter brackets, transformer cases, beams, supports and other related objects. At the present time, several pipe coating companies have built pilot facilities and are supplying coated pipe. Initial emphasis has been placed on coating 2-in. and smaller pipe; however, pilot plant facilities are being expanded to handle larger diameter pipe.

CIRCLE (9) ON THE REPLY CARD

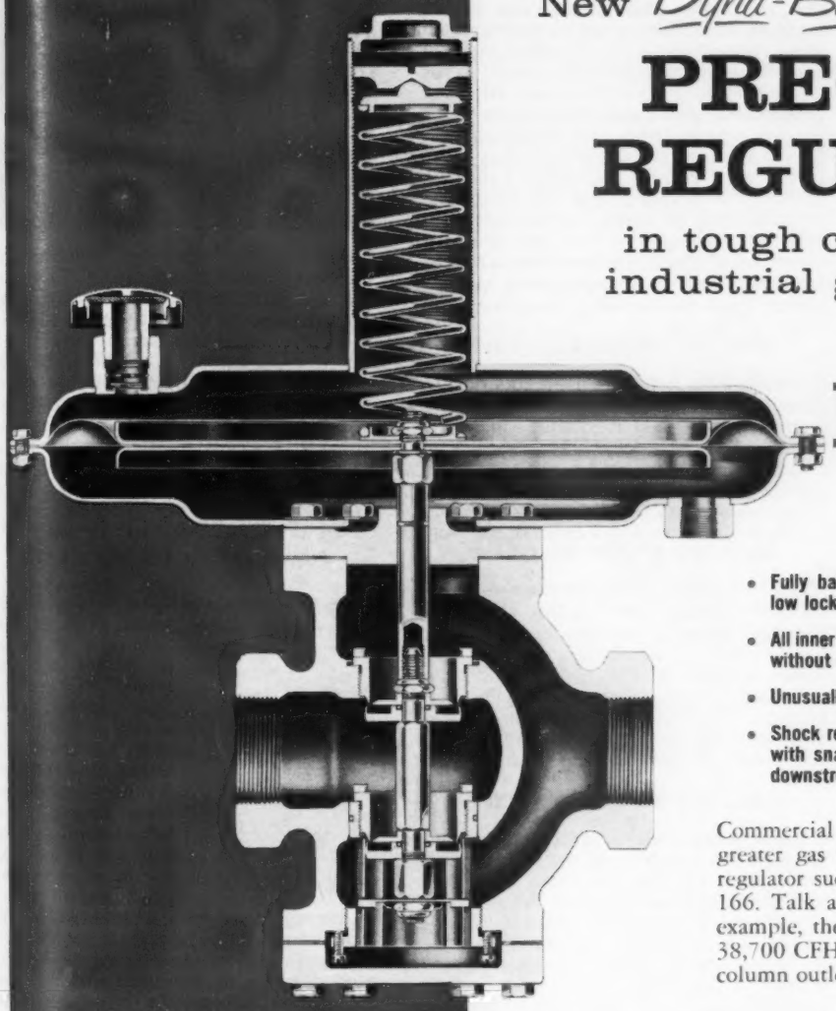
NEW METHOD FOR CLEANING UNDERGROUND VAULTS uses a specially adapted Elgin utility eductor. Unit is self-contained, powered by its own stationary engine which operates the eductor pump and supplies the power for the hydraulic body hoist and hose reel. A vacuum is created at the nozzle which rapidly draws settlings and sludge out of the pit, by-passes the centrifugal pump and deposits the material into the rear compartment of the truck tank. Water is then filtered back to the front of the tank and recirculated. Excess top water in manhole can be prepumped directly into a storm sewer outlet before sludge is removed.

CIRCLE (10) ON THE REPLY CARD

New *Dyna-Balance* Principle for

PRECISION REGULATION

in tough commercial and industrial gas applications



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TYPE 166

- **Fully balanced inner valve provides positive shutoff at low lockup pressure**
- **All inner valve parts easily removable through blind flange without removing regulator from line**
- **Unusually large capacity throughout its performance range**
- **Shock resistant! Controlled pressure holds constant even with snap-acting solenoid valves opening and closing in downstream system**

Commercial and industrial installations requiring greater gas volume have long needed a heavy duty regulator such as the new Dyna-Balance Fisher Type 166. Talk about high capacity—the 166 has it! For example, the Type 166-2 with 1⅞" ports will pass 38,700 CFH of gas with a 5 psi inlet and a 7" water column outlet.

The Dyna-Balance Story

The 166 Series incorporates a boosting principle called "Dyna-Balance". Dyna-Balance minimizes the effect of the main spring on outlet pressure as the flow increases, so that under most pressure and flow conditions the outlet pressure is actually increased with increases in flow. This gives extremely high capacity with little change in controlled pressure.

Construction Data

Regulator is available in two constructions. Type 166-1 has 1" diameter ports and either 1½" or 2" screwed, and 2" 125 pound flanged bodies. The inlet permits up to 125 psi, and outlet 4" W.C. to 10 psi. There are seven different springs available. Type 166-2 has 1⅞" diameter ports. Body size is 2" screwed or 2" 125 pound flange. Pressure range for the inlet is up to 60 psi. Outlet range is 3" W.C. to 5 psi. 166-2 has six springs available.

OUTLET PRESSURE = 7" W.C.		
INLET PRESSURE	TYPE 166-1	TYPE 166-2
	CAPACITY SCFH 0.6 Sp. Gr. GAS FLOW	CAPACITY SCFH 0.6 Sp. Gr. GAS
5 PSIG	17,000	38,700
10 PSIG	25,800	58,000
20 PSIG	40,200	87,600
30 PSIG	51,000	113,500
40 PSIG	62,200	135,500
50 PSIG	73,400	161,000
60 PSIG	85,500	187,000

For Further Information Write For Booklet P-166

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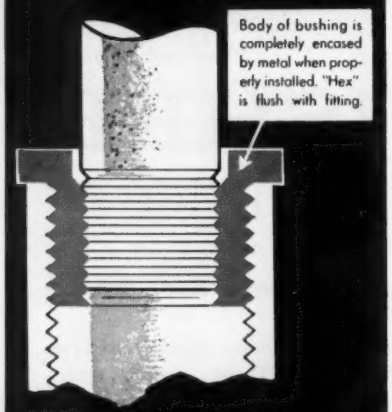
BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIP. CO., CORAOPOLIS, PA.

FISHER® Controls

SINCE 1880

MAYCO

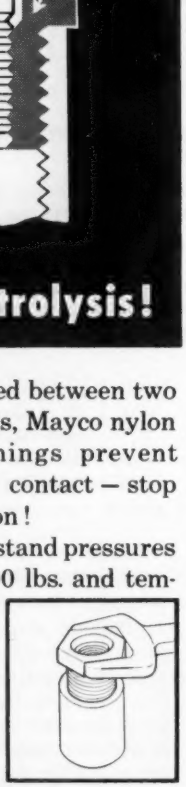
NYLON DIELECTRIC BUSHINGS



Stop Electrolysis!

■ Sandwiched between two dissimilar metals, Mayco nylon dielectric bushings prevent metal to metal contact – stop *electrolytic* action!

Able to withstand pressures in excess of 1000 lbs. and temperatures over 300°F, Mayco dielectric bushings gain added strength from clamping action of surrounding metal.



Most sizes also available with extra-heavy "Hex" to facilitate use of ordinary wrench.

Couplings and unions also available factory equipped with Mayco bushings.

Order Mayco Dielectric Bushings from your jobber or write to:

MAY PRODUCTS, INC.

BOX 427, GALESBURG, ILLINOIS

Manufacturers of: MAYCO dielectric fittings and MAYCO water softeners and filters

Heavy-duty trencher moves easily from job-to-job on rubber-tired wheels; digs 6 ft deep in widths of 15 to 24-in. at 30 ft per minute. Speicher Bros.' Tandem Traction Trencher features a weight shifter that shifts the point of balance 24 in. forward or backward to let the operator cross previously dug trenches without backfilling. This feature also gives trencher better traction on slippery ground. All gears and chains except the digging wheel drives, are sealed in oil. Standard gear-driven conveyor has three speeds plus reverse, however, hydraulic conveyor is available that will dump soil on either side of trench and provide variable belt speeds. Trencher uses standard Chevrolet engines, transmissions, and differential. Unit is exceptionally mobile, moves from job-to-job at over the road speed of 30 mph.

CIRCLE (11) ON THE REPLY CARD

Reynolds Pilot Loaded Gas Regulators are described in 2-color, 4-page brochure from Reynolds Gas Regulator Co. All 4 regulators are used for any type regulation requiring accurate outlet pressure with normal capacities greater than 5000 cu ft per hour. Brochure can be added easily to the main Reynolds Regulator catalog.

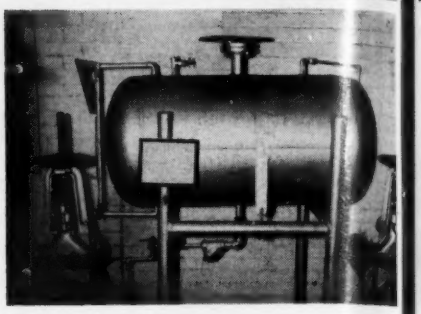
CIRCLE (12) ON THE REPLY CARD

Harper-Wyman's demonstration manual, "How To 'Strike Gold' Selling Gold Star Ranges," outlines step-by-step procedure for 5 simple demonstrations of the customer benefits of the Uni-Matic Flame Selector thermostatic gas range top burner. The 24-page pocket size manual also includes general sales suggestions, and other aids for retail gas range salesmen.

CIRCLE (13) ON THE REPLY CARD

Custom engineered control centers and systems for combustion safeguard and automation are described and illustrated in new 22-page bulletin from Webster Engineering Co. Integrated, packaged control centers insure full coordination of the complete system, place undivided responsibility on one source and reduce field labor to save time and money. Bulletin describes 9 custom engineered centers now in use.

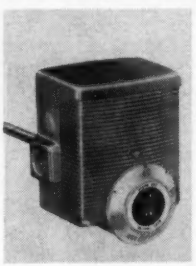
CIRCLE (14) ON THE REPLY CARD



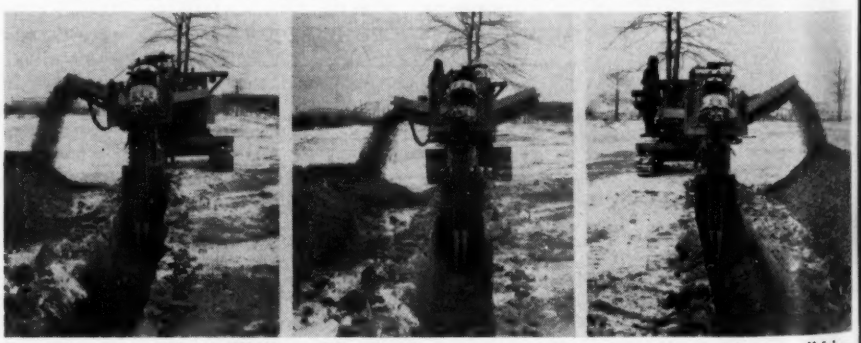
Large city gate odorizers, manufactured by Southern Manufacturing Engineers, Inc. are direct application odorizers that use the pressure drop across an orifice to vary injections. Odorant of any type is stored in suitable tank and amount injected in line is shown by liquid rotameter. This facilitates direct visual check of odorant usage and provides means for immediate control of amount used. Amount of odorant required is read from chart calibrated to pressure drop across orifice. Odorizers are manufactured to customer requirements in any size.

CIRCLE (15) ON THE REPLY CARD

New automatic control designed to provide adequate hot water even in peak periods when the water heater ordinarily would be taxed beyond capacity is now available from Grayson Control Division, Robertshaw-Fulton Controls Co. New device is an adaptation of the 200RB Unitrol, which incorporates a pressure regulator in combination with a thermostat. The new "speed set" control cannot be interchanged with standard controls; it is intended only for use with water heaters specifically designed to operate within a range of 2 to 5½ in. water column pressure limits.

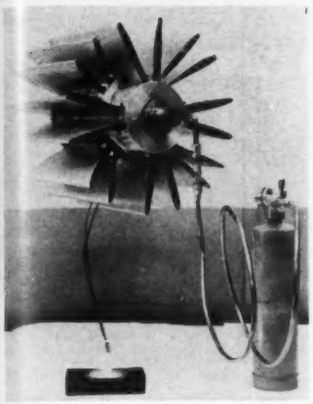


CIRCLE (16) ON THE REPLY CARD



Trencher can dig bellholes. Cleveland Trencher's new JS-30 model can shift the digging wheel laterally while in operation thus permitting the digging of bellholes in normal trenching operation. Unit can dig the edge of a 24-in. wide trench 5 in. outside either track so the trench can be dug flush with parallel pavement, curbs, and sidewalks. It also excavates short runs of extra-wide trench, bellholes, up to 6-ft maximum width without lateral repositioning of its crawler. Hydraulic power-tilting of the digging wheel 7 deg to either side of vertical—a total tilting range of 14 deg—enables the new model to dig vertical trench on side slopes, adjacent to curbing, etc., without cribbing. Power tilt adds 7 in. to outside cut of the digging wheel, and combined with lateral shift, permits digging trench virtually flush with fences, walls, trees, poles, and other above ground obstructions. Standard trench capacity is from 11 to 24 in. wide, down to 5½ ft deep. New model is also equipped with Cleveland's new V-shaped conveyor; permits higher and farther spoil discharge and higher heaped loads on the conveyor belt. Automatic conveyor positioning permits operator to place spoil where needed. All operations of the JS-30 are lever controlled at the operator's seat.

CIRCLE (17) ON THE REPLY CARD



Thermoelectric generator—gas into electricity. General Instrument Corp. has placed on the market what it considers to be the "first practical thermoelectric generator actually made commercially available in the U. S." The small 1-ft high, lightweight (10 lb) automatic "power plant" has no moving parts, can produce electricity for a year on $10 worth of ordinary propane gas, and will keep running as long as the fuel supply lasts. Generator employs "thermopiles" of semiconductor elements to convert heat of burning propane directly into electricity; produces 5 watts of power. Unit has been designed to run for approximately a year on a 200 lb tank of propane gas.

CIRCLE (18) ON THE REPLY CARD

Pipe insulation putty, or molding tape, designed for use as a conformable permanent filling material prior to overwrapping with any of the standard pipe wrapping tapes now on the market has been developed by West American Rubber Company. Tape covers rough edges, fills voids, and forms smooth, even surface. Typical applications include filling of shoulders underneath pipe caps, reducing sharp angle of pipe joints and "tees," and smoothing rough edges of pipe elbows or valves. Butyl compound used in the molding tape never hardens and remains plastic under extreme temperature variations.

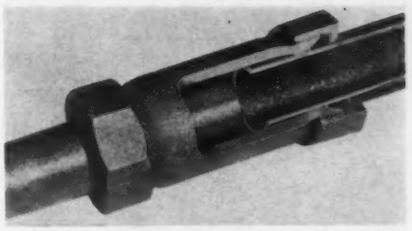
CIRCLE (19) ON THE REPLY CARD

Frank G. Hough Co. has added a new 4-wheel-drive tractor-shovel to its "Payloader" line that has an operating capacity of 3000 lb and is equipped with a 1 cu yd bucket. Unit is powered with a 77½ hp heavy duty gas engine, and has 4-wheel hydraulic brakes instead of 2-wheel in order to provide equal braking action in either forward or reverse. Boom structures are ahead of, and away from the operator to provide utmost safety. Accessibility as well as safety have been given special attention and standard ladder with hand rails make it easy and safe for the operator to get on and off. Both fuel tank and transmission can be checked and filled from ground level.

CIRCLE (20) ON THE REPLY CARD

Maintenance departments can reduce their repair clamp inventory by using Smith Blair's new quick-bolting pipe leak clamp and a new strip-type gridded gasket with metal backing. One clamp width and a gasket strip can be used to make repairs of any length in multiples of 3 in. Specially designed lug base on the clamp is flatter so crush pressure is minimized and a higher circumferential pull is applied. Clamps are faster and easier to install than conventional removable bolt clamps as bolt remains in one lug and is snapped over open slots of opposite lug. Clamps can be stocked in 3-in. band widths, yet be used to make clamps in any multiple of 3-in. length up to 30 in. by using length of strip gasket as long as needed and installing clamps side-by-side.

CIRCLE (21) ON THE REPLY CARD



Malleable couplings announced by Normac have heavier walls and allow more pipe deflection. The new couplings have a wall thickness approximately twice the thickness of the wall of standard steel pipe on which they are used; pipe deflection has been increased to approximately 6 deg on a side. Available in standard pipe sizes ¾ through 2-in.

CIRCLE (22) ON THE REPLY CARD

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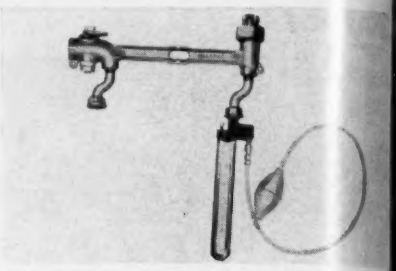
0-L	#0 Emco
1-L	#1 Emco

PRODUCT PARADE

Shallow subsurface exploration using seismic methods is now economically feasible using DynaMetric, Inc.'s new transistorized seismic timer. Unit is applicable for excavation cost estimating, and main line and supply pipeline route planning. New tool allows exploration of the earth to depths of 50 ft or more without drilling and without explosives; locates bedrock, hardpan, large boulders, minor faults, and loose materials. Method is based on measurement of velocity of shock waves moving through surface and subsurface materials. Shock waves are generated by sledgehammer blows against a steel plate; timer measures arrival of the waves at a sensitive geophone. Unit is lightweight, self-powered, and completely portable.

CIRCLE (23) ON THE REPLY CARD

Checking for leaks in gas piping systems is simplified by use of Eclipse Fuel Engineering Co.'s new De-Tekta-Leak device. Unit consists basically of a U-tube manometer with necessary connection fittings and a rubber bulb or small power-driven pump to build up pressure in the system. Leaktight shutoff cock is provided to seal off the system after it has been pumped up; then it is simply a matter of watching the manometer to see if the indicated pressure is retained. Loss of pressure indicates a leak.



CIRCLE (24) ON THE REPLY CARD

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